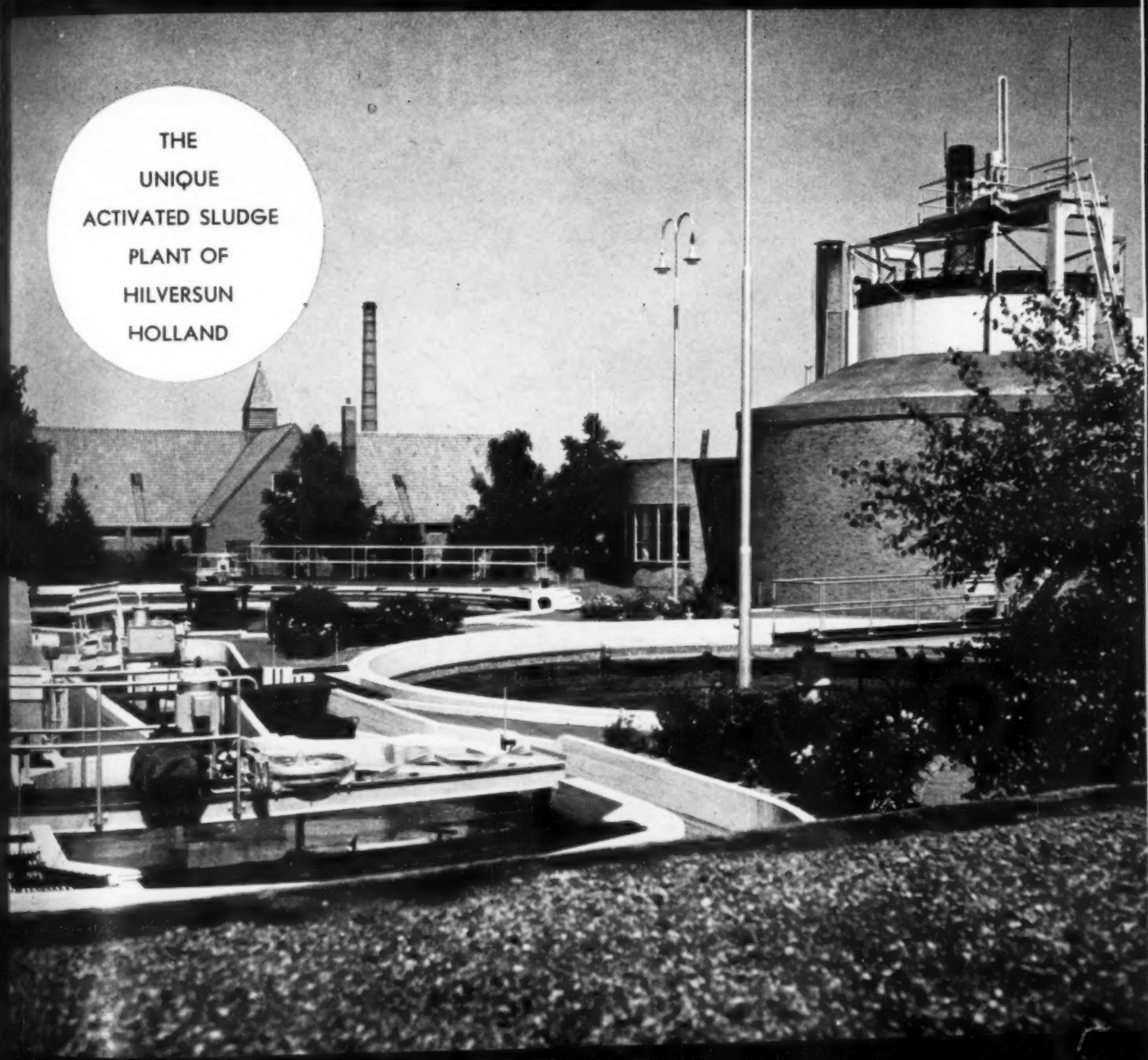
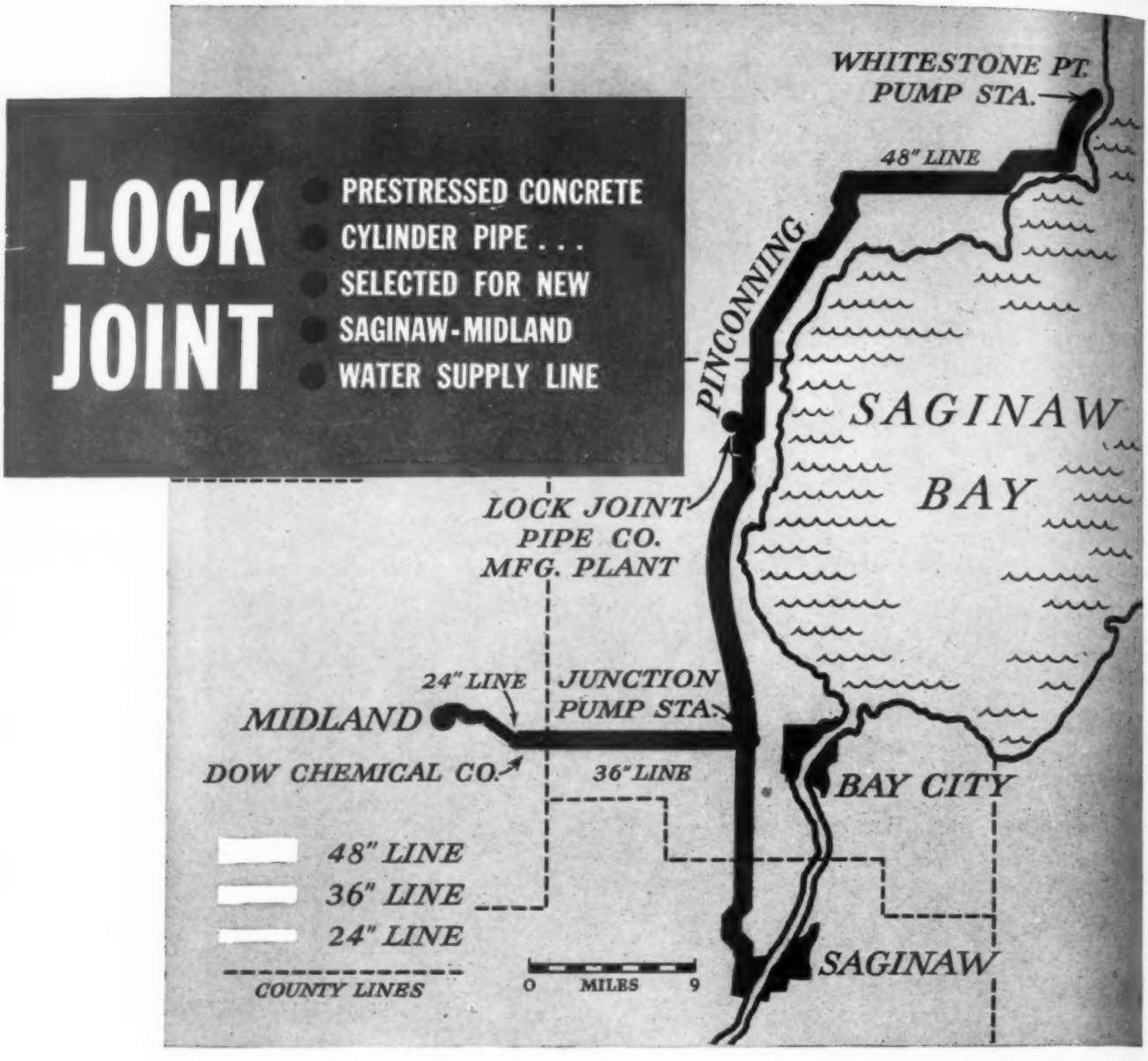
WATER & SEWAGE WORKS





ONCE AGAIN, Lock Joint Prestressed Concrete Cylinder Pipe has been selected for a major water works project.

SPECIFICATIONS issued by the Saginaw-Midland Water Supply Commission call for the manufacture and installation of 254,500 feet of 48 inch pipe . . . 143,230 feet of 36 inch pipe . . . 14,900 feet of 24 inch pipe . . . all operating at a pressure of 130 pounds.

WHEN COMPLETED, this 78 mile water supply line will be capable of delivering 23 MGD to the city of Saginaw and 20 MGD to Midland.

BY SELECTING Lock Joint Prestressed Concrete Cylinder Pipe, the Saginaw-Midland Water Supply Commission assures itself of a pipe line of maximum elasticity, permanent high carrying capacity and an estimated life of one hundred years or more.

LOCK JOINT PIPE COMPANY

Established 1905

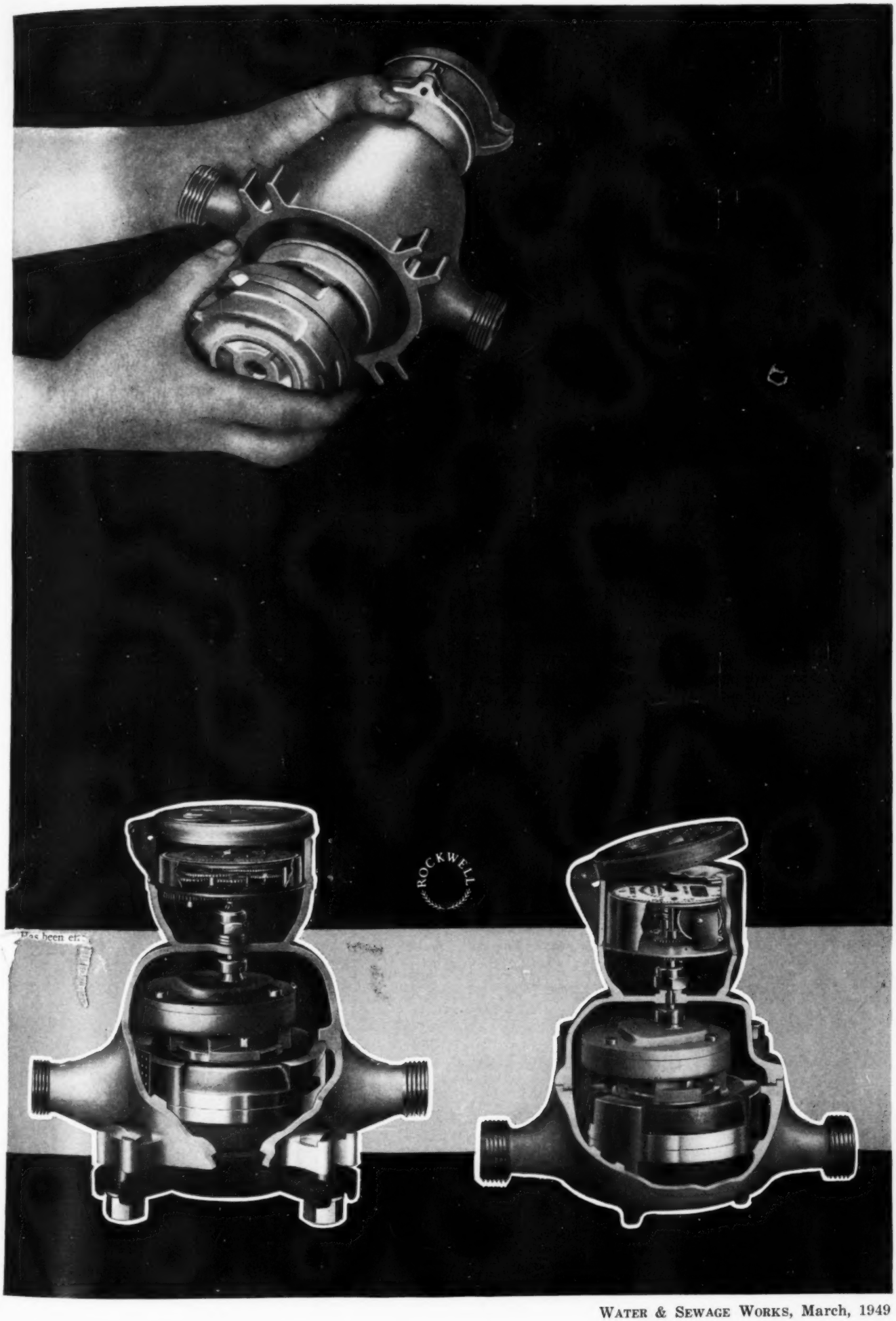
P.O. BOX 269, EAST ORANGE, NEW JERSEY

Denver, Colo. • Chicago, Ill. • Kenilworth, N. J. • Kansas City, Mo. • Rock Island, Ill. Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

•

SCOPE OF SERVICES Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. March, 1949. Volume 96. Number 3. Published monthly by Gillette Publishing Co., at 404 North Wesley Ave., Mount Morris, Ill. Per copy, 25c; except *this issue*, 75 cents. Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as second-class matter March 4, 1948, at the post office at Mount Morris, Illinois, under the Act of March 3, 1879. Executive and business offices, 22 W. Maple St., Chicago 10, Illinois. Editorial office, 155 E. 44th St., New York 17, N.Y.


ROCKWELL

Double-Duty
TROUBLE SHOOTER

Sanitation HTH is the handiest trouble-shooting assistant you could want. Use double-duty HTH for dozens of daily sanitation jobs as well as disaster-size emergencies. Water works men all over the country have found it pays to stock enough HTH for quick, on-the-spot chlorination—anywhere, anytime. A free copy of Mathieson's 48-page manual—"Hypo-Chlorination of Water"—is waiting for you. Write for it. Mathieson Chemical Corporation, 60 East 42nd Street, New York 17, N. Y.

Mathieson
SANITATION HTH

Sanitation HTH . . . PH-Plus (Fused Alkali) . . . Liquid Chlorine . . . Chlorine Dioxide . . . Caustic Soda . . . Soda Ash . . . Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua . . . Dry Ice . . . Carbonic Gas . . . Sodium Chlorite Products . . . Sodium Methylate

Sanitation HTH is available in cases of nine handy 5-lb. cans and in 100-lb. drums

WATER & SEWAGE WORKS

WATER SUPPLY—SEWAGE DISPOSAL—INDUSTRIAL WASTE TREATMENT

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

COMING

A Unique Method of Fluoridation

Is being employed by Madison, Wisc., which had the problem of selecting the most practical scheme of adding fluoride to a number of scattered wells comprising the Madison supply. The scheme selected involves feeding of concentrated Hydro-fluoric Acid directly to the well through the eduction line to the deep-well pump. The feed control is automatic, positive, and essentially fool proof. The timely illustrated description of this extremely interesting and novel fluoridation scheme is that of—

LEON A. SMITH, Supt.
Madison (Wisc.) Water Dept.

Water and Sewage Treatment Chemicals

"Water and Sewage Treatment Chemicals" is the title of a useful reference table which lists the various chemicals used in water and sewage treatment; gives the formulae; shows in what forms available; gives weight per cubic foot; how packaged; solubility factors, and other characteristics. This table also reveals various uses to which each chemical is put and the materials most suitable for dissolving chambers, solution tanks, feed lines, etc. This reference table of many uses, with information heretofore scattered and hard to locate, was developed and prepared at our request by—

HENRY F. MUNROE, Engr.,
Proportioneers, Inc., Providence, R. I.

Mechanization of Water Utility Operations

Is the order of the day and the trend of the times. If you want to know how important this trend is and what mechanization can do for your plant read this article by—

J. G. CARNES, Equip. Engr.
Amer. Water Works Co., Inc.

Preconditioning and Digestion of Sewage Sludge

Is to be discussed in a series of articles by a well qualified author with considerable plant operating experience. These articles are based on lectures by the author before the Short School for Sewage Works Operators at Penna. State College. Although written especially for the benefit of plant operators, these articles are not without value as a guide to plant designers. The contributor, already known to our older readers, is—

T. R. HASELTINE, Partner,
The Chester Engrs., Pittsburgh, Pa.

Chemistry of Water Treatment

Is of particular interest to water purification engineers and chemists, but this series of articles by a well qualified author with considerable plant operating experience. These articles are based on lectures by the author before the Short School for Sewage Works Operators at Penna. State College. Although written especially for the benefit of plant operators, these articles are not without value as a guide to plant designers. The contributor, already known to our older readers, is—

DR. A. P. BLACK,
Prof. of Chemistry, Univ. of Florida.
(Vice Pres. A.W.W.A.)

Automatic Control of Sewage Chlorination at Ft. Wayne, Ind.

Has been effectively practiced since 1941, by means of a recording potentiometer, an automatic rate controller, a vacuum type chlorinator, and a rate recorder. Odor control has been satisfactory, chlorine consumption has been held to a minimum and costs of maintenance have been exceedingly low. The equipment, process, and operation are described by—

RALPH A. HOOT, Supt.
Ft. Wayne, Ind.

Water for Industry

May often be taken for granted, but the quality and quantity of that water may be of far greater importance than water used for normal domestic supplies. Such is the implication of this review of the problem by—

GEORGE W. REID, Assoc. Prof.,
Georgia Inst. of Technology.

Associate Editor
GEORGE E. SYMONS, Ph.D.

Editorial Associates
J. R. BAYLIS
A. M. RAWN
H. A. FABER

Adv. Editor
H. J. CONWAY

Make-Up Editor
L. D. SANDERS

CONTENTS

VOL. 96, NO. 3 MARCH, 1949

Forced Circulation Type Hot Water Heat Exchangers for Digestion Tank Heating 85
By John J. Baffa
New York, New York

A.W.W.A. Board Actions 91

Corrosion Control by the Use of Lime 94
By Edward S. Hopkins
Baltimore, Maryland

Industrial Consumption Effects on "Accounted-For Water" 97
By H. T. Rudgal
Kenosha, Wisconsin

24-Inch Cast Iron River Crossing Installed in Kankakee, Ill. 101
By Dewey Johnson
Chicago, Illinois

Reservoir Construction Costs Lowered by Underdraining Subsoil 103

Twenty-First N.Y.S.S.W.A. Meeting Sets Attendance Record 105
A report by Harry A. Faber
Editorial Associate

European Sanitary Engineering Impressions 110
By Dr. J. V. N. Dorr
New York, New York

Aerobic Treatment of Rum Wastes 112
By Clair N. Sawyer and Earl J. Anderson
Massachusetts Institute of Technology

An Introduction to the Microbiological Utilization and Disposal of Wastes 115
By A. M. Buswell
Urbana, Illinois

We Do Our Digging with a "Hydrocrane" 117
By Lloyd D. Knapp
Milwaukee, Wisconsin

Checking Sewer Velocity 120
By T. C. Williams
Grand Rapids, Michigan

Chlorine Institute Celebrates 25th Anniversary 121

Septic Tank Performance Under Surge Flow Conditions 122
By Harvey F. Ludwig
Pasadena, California

An Ominous Drought 123
By Halbert P. Gillette
San Marino, California

Meetings Scheduled 72A

"Here and There" with Doc Symons 74A

Manufacturers' and Equipment News 87A

Literature and Catalog Reviews 96A

Water & Sewage Works is indexed regularly by Engineering Index, Inc.

Publication Office, 404 N. Wesley Ave., Mt. Morris, Ill.

BUSINESS OFFICE
22 W. Maple St., Chicago 10, Ill.

EDITORIAL OFFICE
155 E. 44th St., New York 17, N. Y.

H. P. GILLETTE, Pres.; E. S. GILLETTE, Vice Pres.; L. H. ENSLOW, Vice Pres.

New York Office.....J. M. Angell, Jr., Mgr., 155 E. 44th Street
Chicago Office.....P. T. Wilson, Rep.
F. H. Bowes, Rep. 22 W. Maple Street
Cleveland Office.....Lee B. McMahon, Mgr., Leader Bldg.
Los Angeles Office....Don Harway, Rep., 1709 W. Eighth Street

WATER AND SEWAGE WORKS is a monthly publication. Single Copies, 25c; Subscription Rates, U. S. and Canada, $2 per year; Foreign, $3.

(Member—Audit Bureau of Circulation and Associated Business Papers.)

The Tanks are Elevated

NOT THE PRICES!

Posey Iron Has Its Own "INFLATION RESISTANCE" Program!

Posey Iron believes that there's no need to elevate prices on elevated tanks. Posey long ago adopted its own inflation resistance program . . . has never raised prices simply to follow the "trend". Instead, Posey engineers bear down to eliminate cost-padding frills and unnecessary steps of construction . . . overlook nothing that will permit estimates that are low for *workmanship of high integrity.*

Posey tanks are welded steel throughout . . . with no rivets where corrosion might gain a foothold. With interior surfaces as smooth and curved as those of a fine ball bearing, Posey Tanks are leak-free . . . corrosion resistant.

The reserve storage provided by Posey Elevated Tanks permits greater flexibility in the design of water works systems. Through use of these tanks, you need install only sufficient pumping and intake equipment to handle normal requirements. Peak loads are taken care of by the reserve in your Posey tanks. Worthwhile savings often result.

Let us know your conditions and we may be able to show you how Posey elevated storage tanks can increase capacity . . . aid production . . . reduce maintenance . . . and perhaps eliminate expensive equipment. Write today. No obligation.

POSEY IRON WORKS, INC.

***formerly* LANCASTER IRON WORKS, INC.**

LANCASTER, PA., U.S.A.

TANKS
WROUGHT IRON, STEEL
AND ALLOY STEEL PIPE
O. D. PIPE

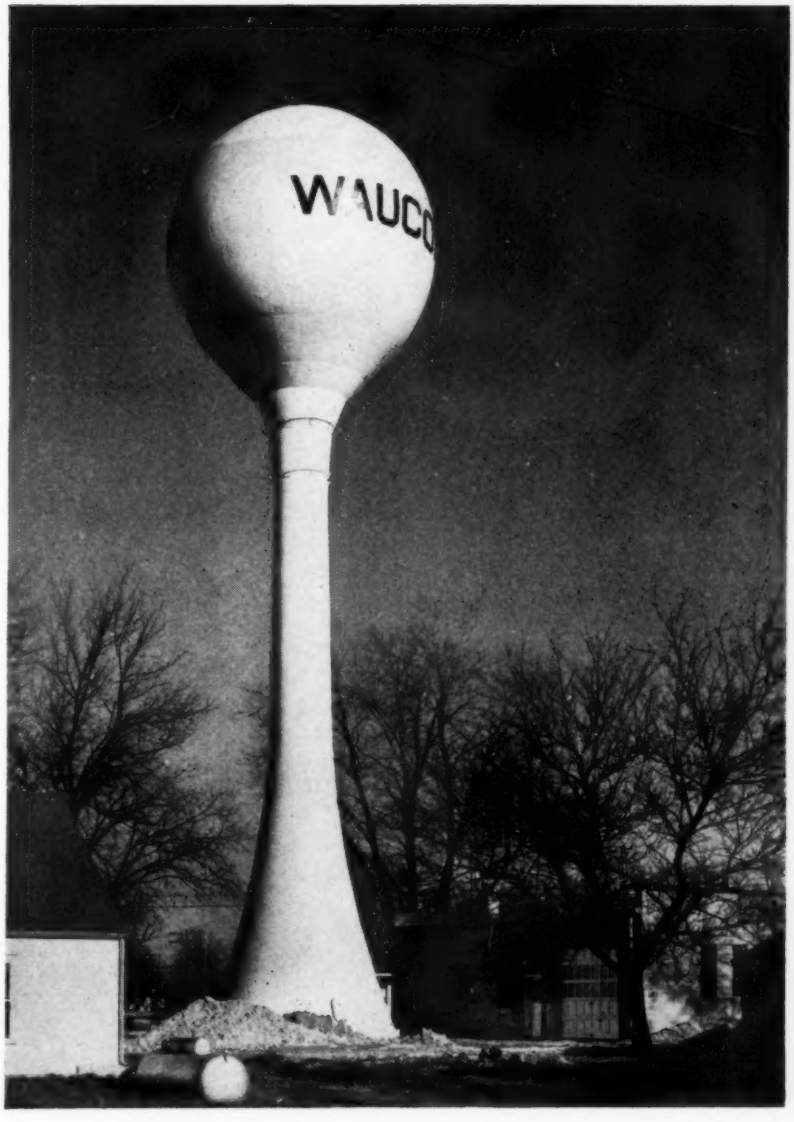
TEES
ELBOWS
AUTOCLAVES
STEEL PLATE CONSTRUCTION

the HORTON watersphere

. . . an entirely new design of a famous HORTON TANK

For those elevated tank installations where graceful appearance and a modern design are important considerations — here's the new Horton Watersphere. This welded steel tank will blend in with the most progressively designed industrial plant as well as fit into any location in a municipal water system. Now—in the new Watersphere—we've even improved on striking design. Its clean lines are unbroken slopes—both the sphere and the base are faired smoothly into the lines of the central column. There are other structural changes, too, which make all the parts of this streamlined structure accessible for maintenance. One of the changes—running the ladder inside the column and up through the center of the sphere—makes it much easier to reach the top of the tank for inspection and painting.

Waterspheres are built in a range of seven standard sizes ranging from 25,000 to 100,000 gallons, in heights of 50, 75, 100 and 125 ft. to bottom. We shall also be glad to quote on larger sizes or any intermediate heights to meet your needs.



Above: A new 100,000-gal. Horton Watersphere, 75 ft. to bottom, providing gravity pressure in the water system at Wauconda, Illinois. The average daily consumption of water in Wauconda is 55,000 gals. in Winter and 110,000 gals. in Summer.

CHICAGO BRIDGE & IRON COMPANY

Atlanta 3.....2181 Healey Building
Birmingham 1.....1586 North Fiftieth Street
Boston 10.....1048-201 Devonshire Street
Chicago 4.....2198 McCormick Building
Cleveland 15.....2262 Guildhall Building
Detroit 26.....1551 Lafayette Building
Houston 2.....2115 National Standard Building
Havana.....402 Abreu Building
Los Angeles 14.....1455 Wm. Fox Building
New York 6.....3390-165 Broadway Building
Philadelphia 3.....1644-1700 Walnut Street Building
Salt Lake City 1.....1550 First Security Bank Building
San Francisco 11.....1283-22 Battery Street Building
Seattle 1.....1350 Stuart Building
Tulsa 3.....1646 Hunt Building

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

8 P. F. T. Floating Covers

FOR
PHILADELPHIA'S
NORTHEAST TREATMENT
WORKS

PLUS

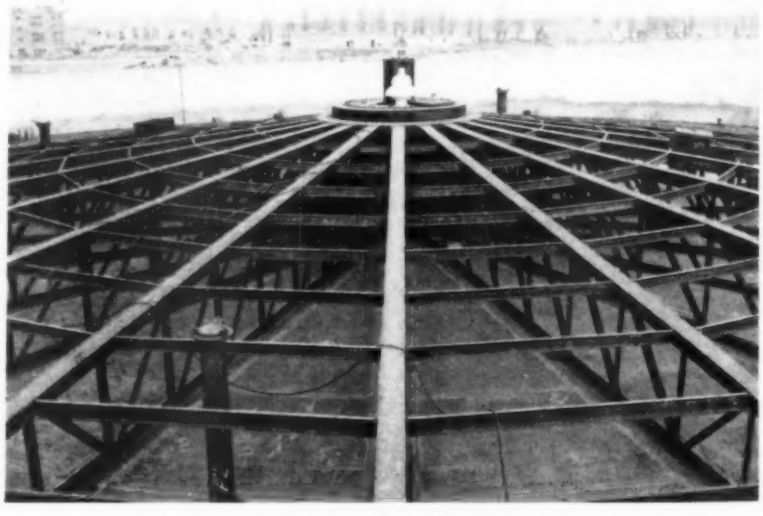
TWELVE P. F. T. Supernatant Selectors and Supernatant Guage, Sight-Glass and Sampler Units.

EIGHT P, F. T. Cover Position Guage Boards consisting of 4 scales each with low level alarms.

P. F. T. Equipment has a banner role in the nearly-completed plant additions at Philadelphia's *Northeast* Treatment Works.

The eight floating covers to fit 110' 6" diameter digestion tanks plus the equipment above will serve the digestion capacity of 2,420,000 cu. ft. provided for a design population of 870,000. Solids to be handled by the digesters will consist of primary and waste activated sludge for the treatment of an average design flow of 125 m. g. d.

In addition, the aeration tanks have been so constructed that the activated sludge process may be operated under the licensed P. F. T.-Kraus "Digester Liquor Nitrification Process" to provide a positive control and elimination of sludge bulking and to make beneficial use of the digester liquor. Write for complete details about the P. F. T. equipment that is providing "Safe Sanitation for the Nation."



Above: Eight 110' 6" Diameter Digesters with P. F. T. Floating Covers, *Northeast* Treatment Works, Philadelphia, Pa. (Bureau of Engineering, Department of Public Works, City of Philadelphia, Engineers).

Below: Closeup of one of eight P. F. T. Floating covers for 110' 6" diameter digesters at *Northeast Plant.*

P.F.T. **PACIFIC FLUSH TANK CO.**

SEWAGE TREATMENT EQUIPMENT EXCLUSIVELY SINCE 1893

4241 RAVENSWOOD AVENUE CHICAGO 13, ILLINOIS

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • DENVER • TORONTO

Why not anticipate these consumer complaints about unpalatable water? Many plants are now finding it advantageous to apply small dosages of Aqua Nuchar Activated Carbon continuously to prevent a sudden taste or odor condition from getting out of hand. Thus, when tastes and odors develop in a raw water supply, it is only necessary to apply somewhat increased dosages of Aqua Nuchar to bring the condition quickly under control.

Aqua Nuchar Activated Carbon has "built-in" qualities that permit it to disperse more quickly throughout the entire body of water and to remain in suspension a longer period of time. This gives the extremely porous Aqua Nuchar particles a greater opportunity to contact taste and odor bodies in the water and to remove them by *adsorption*.

With Aqua Nuchar, you can now deliver a truly palatable water to consumers for an average of less than two cents per capita per year.

INSURES PALATABLE AQUA NUCHAR DRINKING WATER

industrial CHEMICAL SALES

division west virginia pulp and paper company

NEW YORK CENTRAL BLDG.	PURE OIL BLDG.	PUBLIC LEDGER BLDG.	LEADER BLDG.
230 PARK AVENUE	35 E. WACKER DRIVE	INDEPENDENCE SQUARE	526 SUPERIOR AVE., N.W.
NEW YORK 17, N. Y.	CHICAGO 1, ILLINOIS	PHILADELPHIA 6, PA.	CLEVELAND 14, OHIO

OTHER PRODUCTS: *Snow Top Precipitated Calcium Carbonate • Nuchar Activated Carbons • Liqro Crude Tall Oil • Indusoil Distilled Tall Oil Tallene Tall Oil Pitch • Tallex Abietic Acid • Sulfate Wood Turpentine • Alpha Pinene • Beta Pinene • Polycel Cellulose Fibers • Indulin (lignin)*

Figure the Angleflow when you want BIG volume

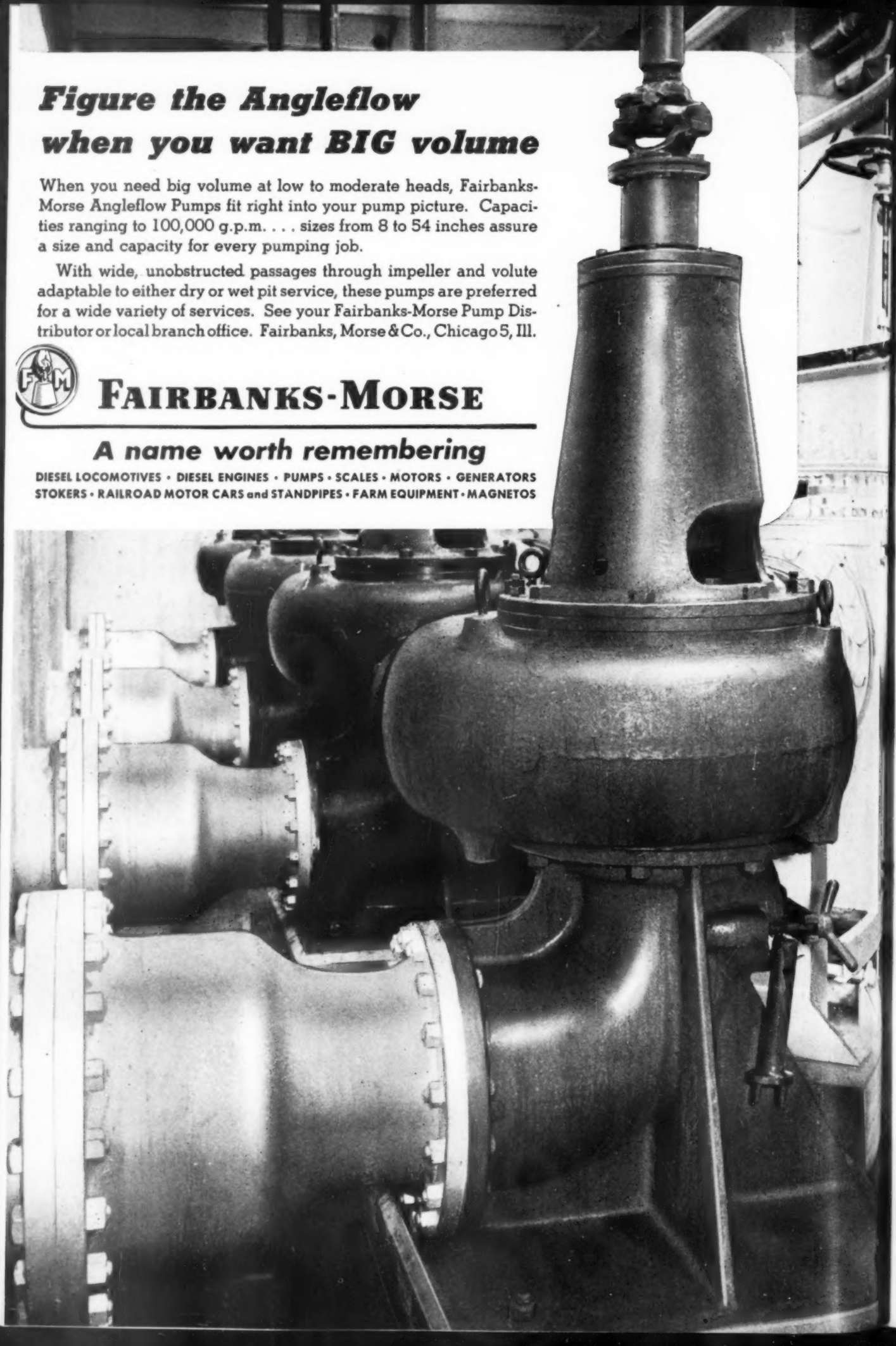
When you need big volume at low to moderate heads, Fairbanks-Morse Angleflow Pumps fit right into your pump picture. Capacities ranging to 100,000 g.p.m. . . . sizes from 8 to 54 inches assure a size and capacity for every pumping job.

With wide, unobstructed passages through impeller and volute adaptable to either dry or wet pit service, these pumps are preferred for a wide variety of services. See your Fairbanks-Morse Pump Distributor or local branch office. Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE

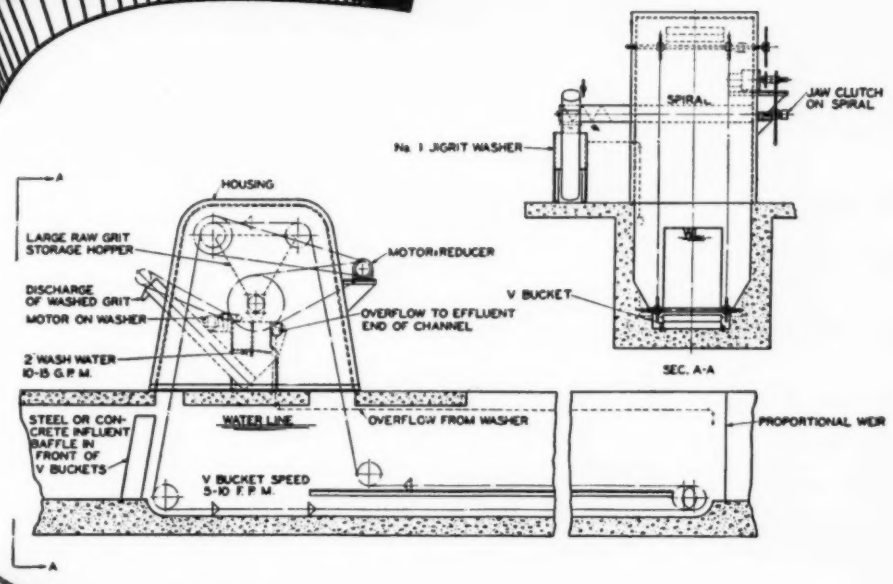
A name worth remembering

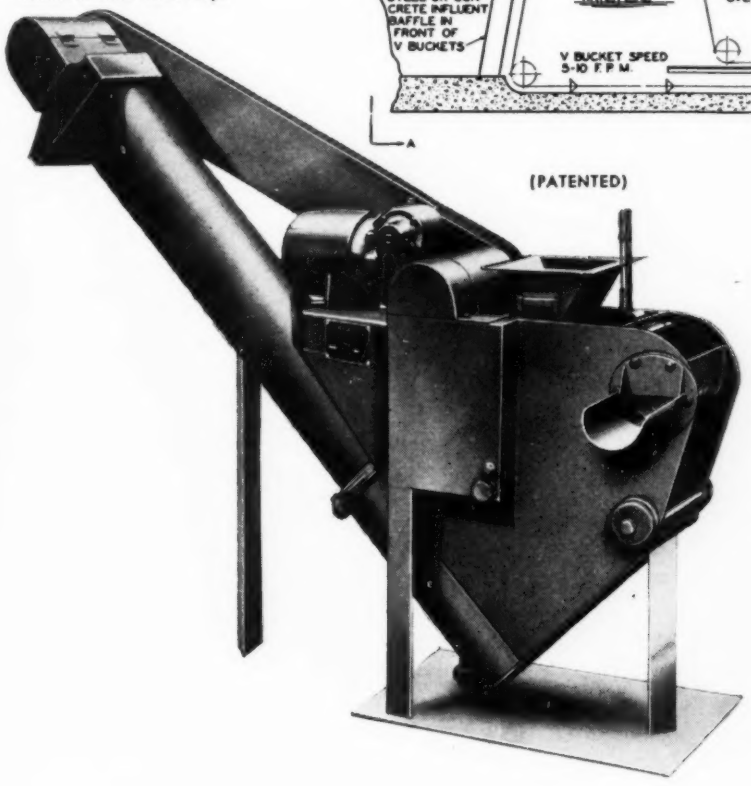
DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS • GENERATORS
STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS



85% REMOVAL OF ORGANICS with "JIGRIT" WASHERS

Satisfactory and efficient grit washing is possible in any size community by using the Jeffrey system (see drawing) of grit collection and washing. Our field studies show that for best results the grit should be collected by one mechanism and washed in a separate unit. Automatic control makes it possible to operate each device a minimum time each day.





(PATENTED)

Left — Jeffrey "JIGRIT" No. 1 — a basket type jig for classifying and removing putrescible solids from sewage grit in plants of moderate size. Capacity — 20 cubic feet per hour. 90% recovery of inorganic grit. Produces a washed grit that can be used for fill or dumped anywhere without nuisance. Also No. 4 "JIGRIT" washer for washing grit at rate of 120 cubic feet per hour, and No. 9 for 280 cubic feet per hour . . in single units fully automatic in operation.

Bar Screens • Sludge Collectors • Sludge Elevators • Grit Collectors • Screenings Grinders
Garbage Grinders • Conveyors, Chains and Bearings • also equipment for biofiltration plants

JEFFREY

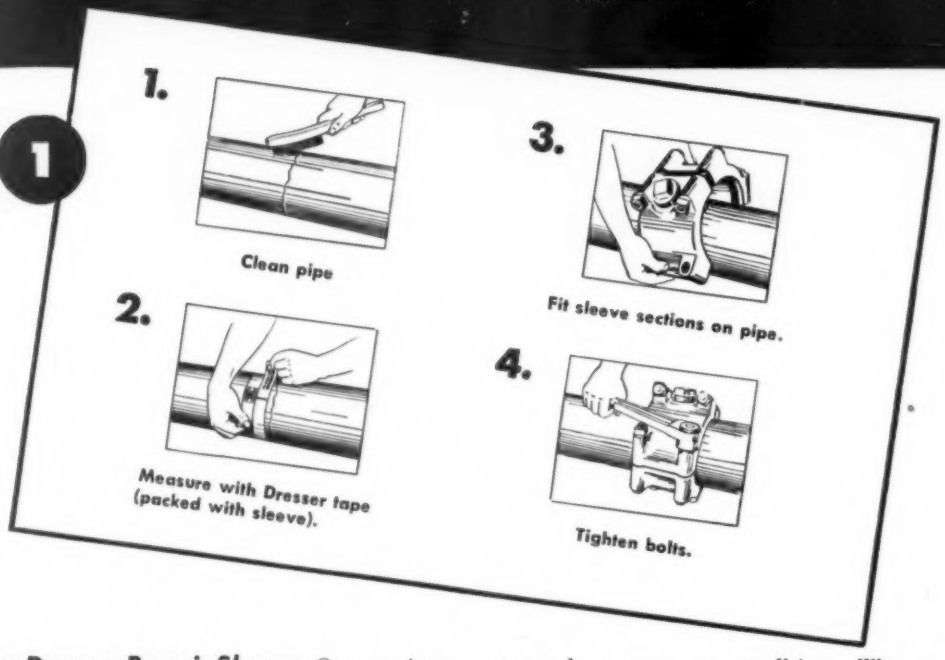
ESTABLISHED 1877

JM

THE JEFFREY MANUFACTURING COMPANY, 996 North Fourth Street, Columbus 16, Ohio

2 EASY WAYS to repair water lines

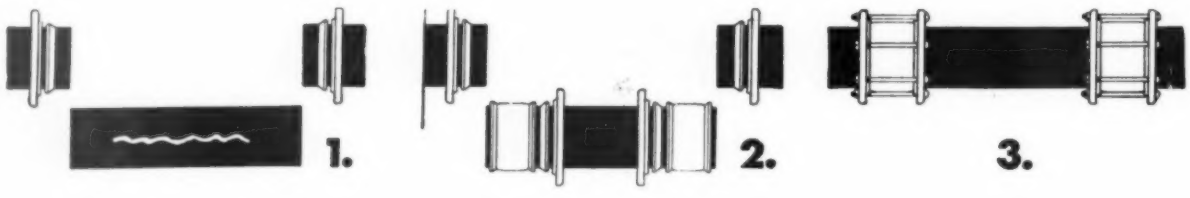
1



With a Dresser Repair Sleeve. On cast iron pipe, 4″ to 8″ in diameter, for splits, breaks or holes, use a Dresser Style 82 "Adjustable" Repair Sleeve. One man can make a permanent repair in a matter of minutes, using only a wrench. Sleeve is factory-assembled; no loose parts, no gaskets to cut and fit when seconds count, no caulking. The specially compounded Dresser gaskets afford a quick pack—a permanent seal.

Note: The Dresser Style 82 Repair Sleeve also offers the most convenient method for making a large tap off a small diameter main.

2



With Dresser Couplings. For breaks too long to be repaired with a sleeve, use Dresser Style 38 Couplings. Cut out a section of the pipe where the break occurs. Fit the couplings onto pipe ends. Put a new section in place. Bolt up the couplings. That's all there is to it. Dresser's resilient rubber gaskets assure a permanently tight repair . . . and guard against recurrence of the break by absorbing stresses and strains in the line.

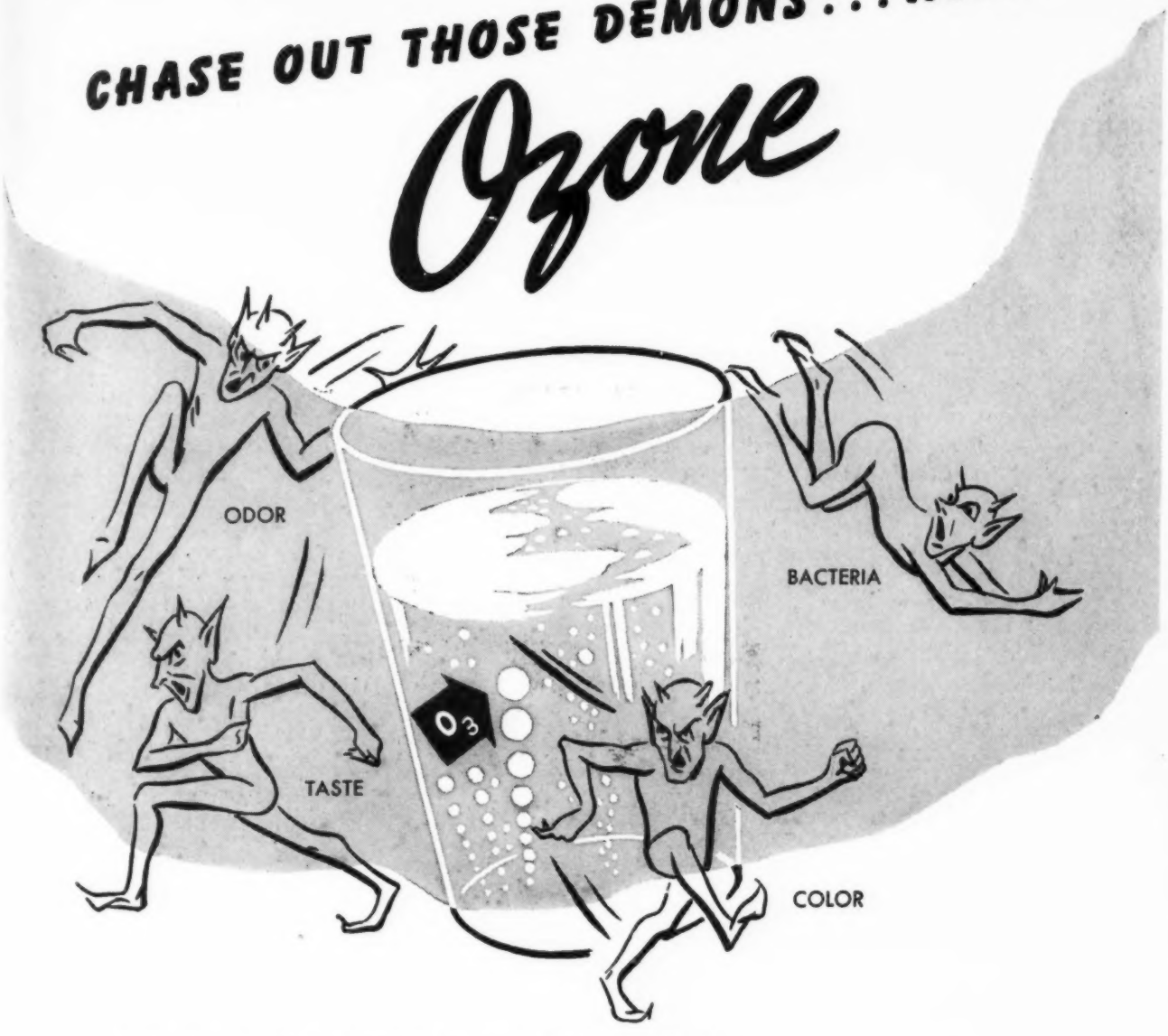
Note: This same procedure can be followed for cutting a new line into an old one, for inserting a valve into a line and for solving similar problems.

DETAILED, FACTUAL LITERATURE on how Dresser products can solve your water line repair and coupling problems is yours for the asking. Write today.

DRESSER COUPLINGS and REPAIR PRODUCTS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries) • In Texas: 1121 Rothwell St., Houston
In Canada: 629 Adelaide St., W., Toronto • Sales offices: New York, Chicago, Houston, San Francisco

CHASE OUT THOSE DEMONS...WITH Ozone



Ozonation comes to the rescue of even the most difficult water purifying problems! There's no need to put up with disagreeable tastes, odor or unsightly color. Why not call on the years of Ozone research and experience of The Welsbach Corporation, designers and builders of the world's largest Ozone installation for the treatment of municipal water at the Philadelphia Belmont filtration plant. This Ozone installation will eventually treat 70,000,000 gallons daily. OZONE PURIFICATION alone, or in combination with other standard treatments, may be the answer to YOUR taste, odor and color problem.

READ HOW PHILADELPHIA turned to Ozone water treatment: Send today for your copy of the booklet, "Philadelphia Finds the Answer!"

THE WELSBACH CORPORATION

OZONE PROCESSES DIVISION

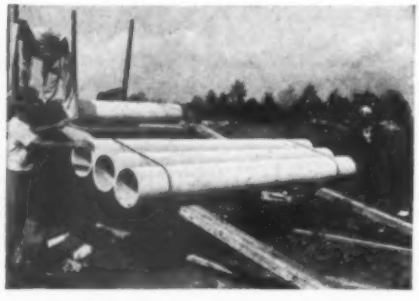
1500 Walnut Street Philadelphia 2, Pa.

Engineering Facts about
Johns-Manville TRANSITE PRESSURE PIPE
Installation Economies

SINCE the cost of installing the transmission and distribution lines may represent as much as 30 per cent of the total original investment in a water supply system, it is important that these costs be kept to a minimum. Transite* Pressure Pipe offers a combination of installation advantages which have resulted in substantial economies wherever this pipe has been used.

These installation economies start when a Transite Pipe shipment is received. Because Transite is relatively light in weight, unloading and all subsequent handling operations are simplified. More footage can be handled per truckload, trucking costs are lower, and distribution on the job site is easier and more quickly accomplished.

Mechanical handling equipment is not usually necessary except where the larger diameters of pipe are used. The sections of pipe are easily lowered into the trench, either by hand or with the aid of rope slings.



All but the larger diameters of Transite Pipe are unloaded without mechanical equipment and lowered into the trench with slings. Lightness, ease of handling and ready workability contribute to Transite Pressure Pipe's many desirable installation advantages.

In this Transite installation at Long Beach, California, the pipe was laid as fast as the trench was opened. Not more than two newly laid lengths of pipe were ever exposed at one time.

Transite's factory-made Simplex Couplings provide a number of additional installation economies.

Consisting of only three simple parts, this coupling is rapidly assembled to provide a tight, yet flexible joint. A coupling puller is the only tool required for assembly. So rapidly can the pipe be assembled in the trench that the same foreman often supervises both excavation and installation. And this speed of assembly means that trenches need be open only a minimum length of time.

Each joint, moreover, is readily checked for correct assembly as the pipe is laid. This provides advance assurance that the line will meet final test requirements and is a further help in expediting completion of the job.

The flexibility of the Transite Simplex Coupling affords another advantage. It permits deflections up to 5° at each joint, thereby allowing the pipe to be laid around wide curves and across hilly terrain without the use of special fittings.

The workability of this pipe is also a contributing factor to its economy of installation. Transite is adapted to standard water works practice and is readily connected to valves, fittings, hydrants, etc. It is tapped and drilled with standard equipment. The threads are sharp, clean and strong—connections are tight and lasting. Conventional methods are used for making large service connections.

For further details about Transite Pressure Pipe, write Johns-Manville, Box 290, New York 16, N. Y.

Assembling Simplex Couplings is a quick operation. And each joint can be easily checked for proper assembly when it is made, providing advance assurance that the line will meet final test requirements.

JOHNS-MANVILLE JM PRODUCTS

*Transite is a Johns-Manville registered Trade Mark

Chemicals you live by

IT'S SOMETHING TO SING ABOUT—AGAIN!

Cleaning up our rivers, streams and lakes holds rich rewards for industry and government . . . and you. When "the old mill stream" offers abundant clean water and is a fit place for recreation. it means better employee and community relations. It's also an invitation to others to live and work by its banks.

For years DIAMOND ALKALI has helped communities purify the water drawn *from* streams and lakes for people to drink. That's just one half of the problem. Treating the waste and sewage that pours *back* is the other half.

DIAMOND chemicals are ready to help there, too, wherever they can. DIAMOND Chlorine, for example, will cut down bacteria count. DIAMOND Silicates help settle out dirt and impurities. DIAMOND Caustic Soda and Soda Ash can neutralize destructive acids.

In treating water, and in countless other ways, DIAMOND products . . . *Chemicals You Live By* . . . are vital to everyone's well-being. They contribute to your health, comfort and pleasures, daily.

THIS ADVERTISEMENT is one of a series appearing in Time and Newsweek to broaden public interest in your activities and ours. We will welcome your inquiries on Diamond Alkali chemicals.

DIAMOND ALKALI CHEMICALS

DIAMOND ALKALI COMPANY ◆ CLEVELAND 14, OHIO

YOU

ARE YOU SURE OF YOUR GATE VALVES?

YOU

YOU

GATE VALVES are used so seldom you can't help feeling uncertain how they will work the next time. That's why cautious buyers base their choice on performance records.

And that's why an overwhelming number of them choose R. D. Wood Gate Valves. They know the reputation of these valves for long and dependable service. Only 3 moving parts to the internal mechanism—spreader and discs. The discs are free to rotate their full circumference when raised or lowered; they are not subjected to drag—and wear at any one point. In closing, pressure is evenly distributed at the center of the discs, which seats them tightly without distortion. No small parts to go wrong. No pockets to collect sediment. Unobstructed flow of water.

Send for complete details. Give your community the safety plus of R. D. Wood Gate Valves, proved in generations of use.

Seasoned castings. Rigidly inspected. For working pressures up to 175 lbs. Tested to 300 lbs. Conforming to AWWA specifications. Bell or flanged ends, or to connect with any standard type of joint. 2" to 30".

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (Centrifugally Cast in Sand Molds)

NEW HORIZONS . . . IN FLOW METERING

NEW
BETHLEHEM FLOW TUBE

Gives Higher Accuracy . . .
More Economy . . . Over a Greater Range

GENTILE PATENTS*

Now! An entirely new flow meter! Tested by one of the nation's leading hydraulic laboratories. Performance-proved for large savings in power, higher product quality, more economical installation.

It's the BETHLEHEM FLOW TUBE, the first primary element ever to use viscosity as a criterion of flow. Wherever the rate of fluid flow must be measured, the Bethlehem Flow Tube offers:

- **A constant coefficent over an 8:1 range of discharge**
- **Negligible resistance to flow**
- **A differential greater than that of a Venturi tube or orifice meter**
- **Length normally less than 1 pipe diameter**
- **No straight run limitations**
- **Accuracy constant over the entire range of commercial flow measurement**
- **Metering of gases as easily as liquids**
- **Metering of both direct and reverse flow**

Full details are available in the folder, "BETHLEHEM FLOW TUBE." For your copy write Bethlehem Foundry & Machine Company, today.

*Pronounced Gentilly

BETHLEHEM FOUNDRY

& MACHINE COMPANY • BETHLEHEM • PENNA.

DIXIE TANK AND BRIDGE CO.

3523 LAMAR AVE.—P. O. BOX 14, MEMPHIS 1, TENNESSEE

THE SILENT WATCHMAN

REPRESENTATIVES IN THE FOLLOWING CITIES:

SALT LAKE, UTAH Box No. 1202
DETROIT, MICH. Box No. 1423
RALEIGH, N. C. Box No. 251
SYRACUSE, N. Y. Box No. 681
BUTTE, MONTANA Box No. 383
GREENVILLE, S. C. Box No. 1074
TAMPA, FLORIDA Box No. 1642
RICHMOND, VA. Box No. 886
NEWARK, OHIO Box No. 623
FARGO, N. D. Box No. 1472
COLUMBIA, S. C. Box No. 472
DALLAS, TEXAS Box No. 1881
DENVER, COLO. Box No. 2037
WAUSAU, WIS. Box No. 682
SAN FRANCISCO, CAL. Box No. 1445
COLUMBIA, MO. Box No. 522
SPOKANE, WASH. Box No. 906
MACON, GEORGIA Box No. 402
PROVIDENCE, R. I. Box No. 202

Complete Service for Elevated Water Tanks—

30 Years Experience

BE SAFE DON'T GAMBLE!

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress.

On completely re-conditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years. Yearly inspection, making all adjustments, if any, without additional cost.

Write Us for Free Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

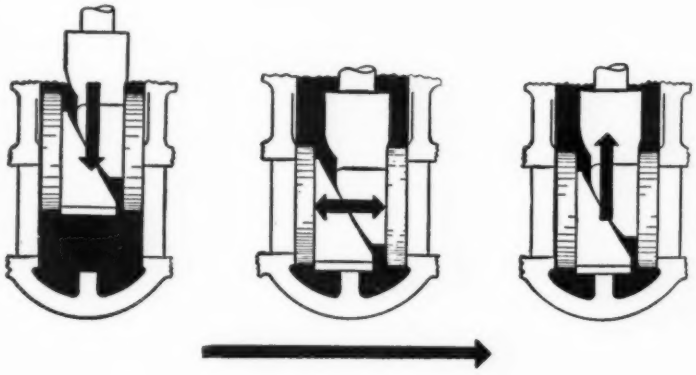
—SAFETY—SERVICE—SATISFACTION—

COPYRIGHT, 1947

THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

*Ingenuity in gate valve design fulfills seven objectives**

ELIMINATION OF DISC-TO-SEAT FRICTION AND GALLING

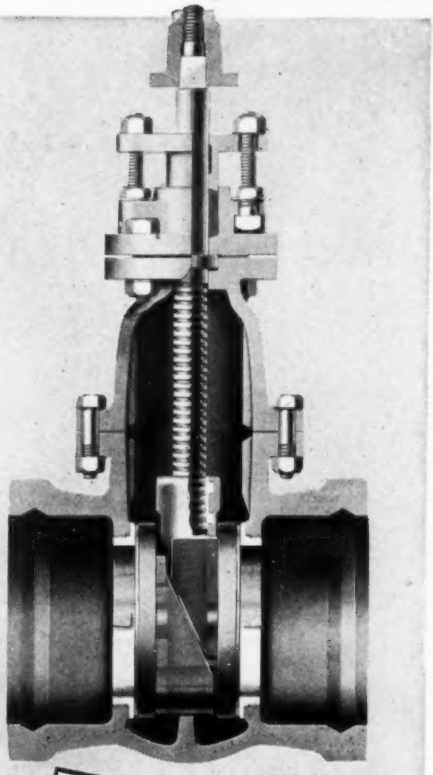


THOUSANDS of valves are ruined every year because their design makes it necessary to "jam" them shut and "break" them open. The valve discs and seats are subjected to severe friction and galling, a major cause of leaks, unreliable performance and excessive maintenance cost.

The above sketches show how this condition has been completely eliminated in the unique design of Darling Fully Revolving Double Disc Parallel Seat Gate Valves. The discs are lowered all the way with minimum disc-to-seat friction. Next, the positive wedging action spreads the discs for tight contact against their seats. When opening the valve, the first turn of the stem completely releases wedging pressure on the discs.

This is a unique, positive release feature—one of the principal reasons why hundreds of users have found Darling Valves so reliable and easy to operate—sure to last longer, with minimum maintenance cost.

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 1, PA.



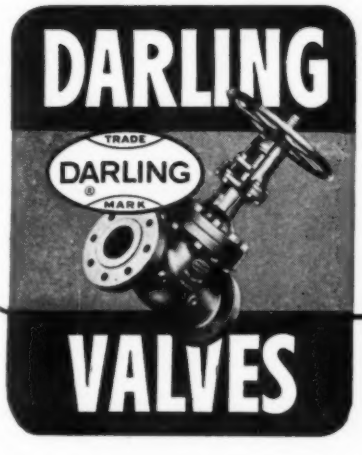
*This advertisement is one of a series showing how the unique Darling Fully Revolving Double Disc Parallel Seat Gate Valves answer the following critical operating problems:

- Positive, easy closing—regardless.
- Automatic adjustment for valve body distortion.
- Elimination of disc-to-seat friction and galling.
- Uniform wear distribution.
- Extreme simplicity.
- Greater service life.
- Simplified maintenance.

Darling Parallel Seat Gate Valves are available in a wide range of sizes and constructions for all types of normal and unusual service, and for pressures up to 3000 pounds. Likewise, Darling Taper Seat, Solid or Slotted Wedge Gate Valves are available for most services.

CORROSION RESISTANT VALVES

In addition to conventional iron, bronze and steel constructions, Darling specializes in valves for any corrosive fluid: iron body valves with special alloy trim; iron body, rubber lined with special alloy trim; all bronze; and all special alloy. Darling's 50 years of experience in meeting unusual requirements is always at your service.

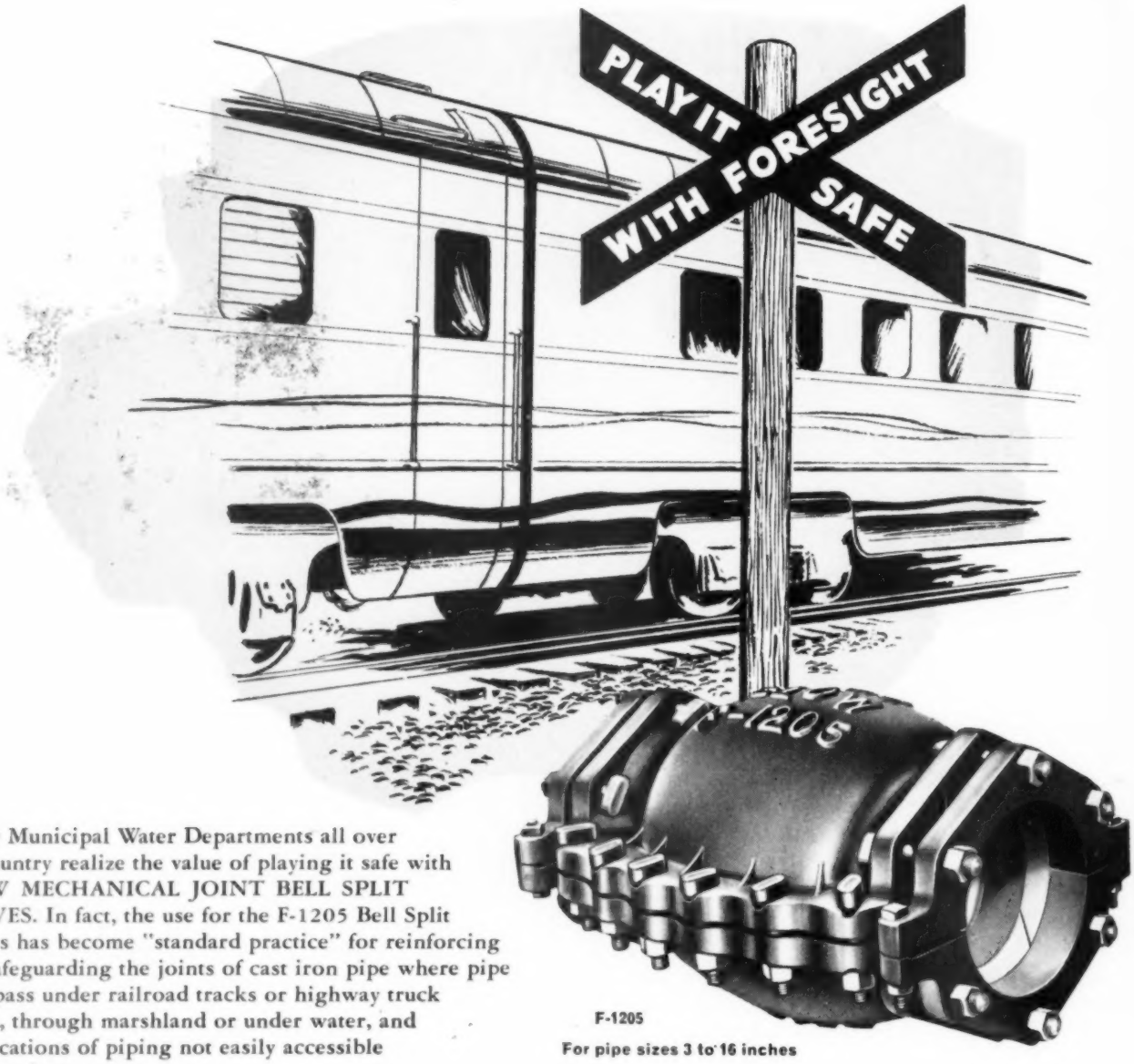


Outline your needs and ask for specific data on the proper Darling Valves . . . or send for the complete 300-page Darling Catalog No. 17M. It describes Darling Valves of *all* types and is full of valuable information.

THE VALVE MARK OF QUALITY : : : WATCH FOR IT

Where the pressure's on – reinforce and protect all joints of cast iron pipe with

CLOW BELL SPLIT SLEEVES



Today Municipal Water Departments all over the country realize the value of playing it safe with CLOW MECHANICAL JOINT BELL SPLIT SLEEVES. In fact, the use for the F-1205 Bell Split Sleeves has become "standard practice" for reinforcing and safeguarding the joints of cast iron pipe where pipe lines pass under railroad tracks or highway truck routes, through marshland or under water, and any locations of piping not easily accessible in case of emergency.

F-1205
For pipe sizes 3 to 16 inches

No Lead . . . No Jute . . . No Calking

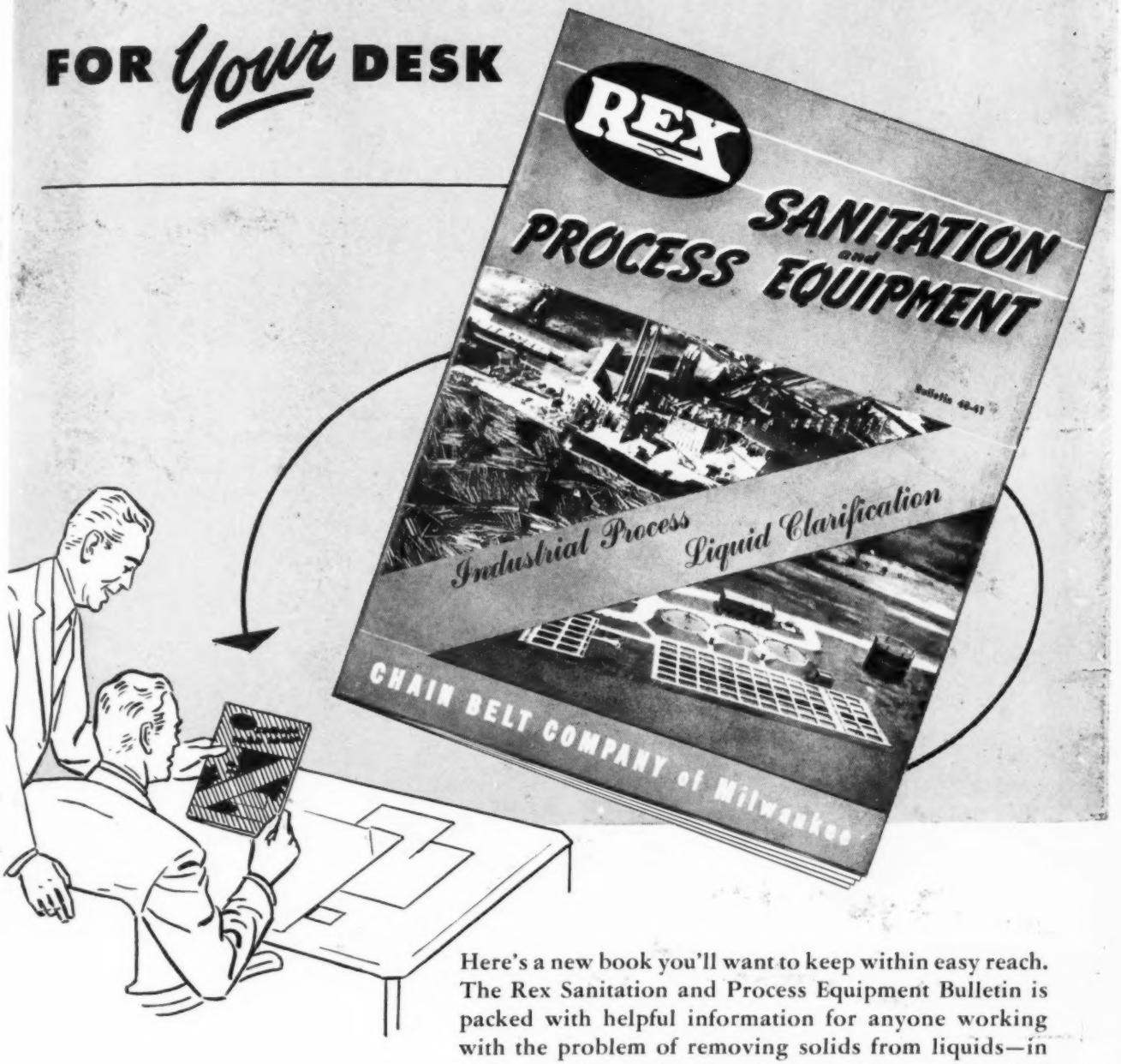
Write for completely illustrated descriptive circular

F-1200
For pipe sizes 3 to 16 inches

JAMES B. CLOW & SONS
201-299 North Talman Avenue • Chicago 80, Illinois
and their National Cast Iron Pipe Division, Birmingham, Ala.; subsidiaries Eddy Valve Co., Waterford, N. Y.; Iowa Valve Co., Oskaloosa, Ia.

Make repairs to pipe barrel with F-1200 Clow Mechanical Joint Straight Split Sleeves. Sizes 12-inch and smaller will repair length-wise breaks up to 8 inches; sizes 14-inch and 16-inch, up to 17 inches.

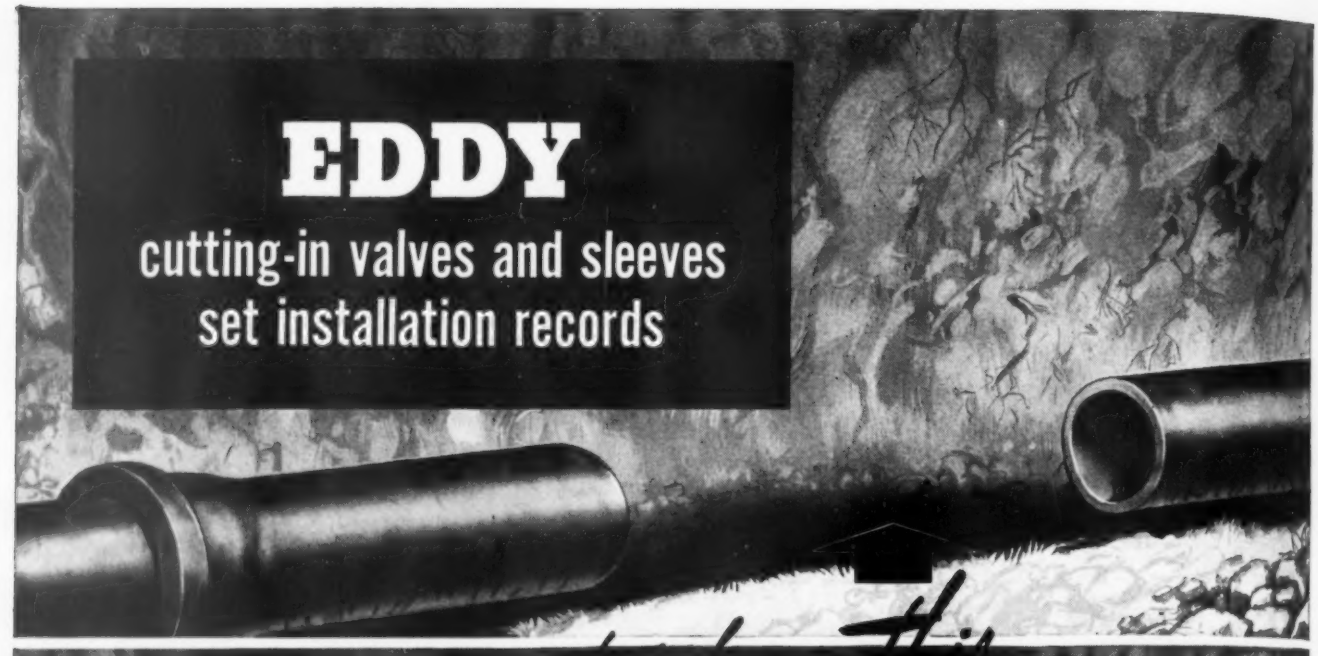
A VALUABLE BOOK FOR *Your* DESK



Here's a new book you'll want to keep within easy reach. The Rex Sanitation and Process Equipment Bulletin is packed with helpful information for anyone working with the problem of removing solids from liquids—in both municipal and industrial fields. Here are detailed discussions of general principles . . . plans and sectional views of equipment and installations . . . specifications . . . data on auxiliary equipment . . . suggestions for special uses and industries . . . a table of useful conversion factors.

Yes, you'll want Bulletin 48-41 at your finger tips to help you plan your installations and select the right equipment. Write for your free copy today. Address Chain Belt Company, 1610 West Bruce Street, Milwaukee 4, Wis.

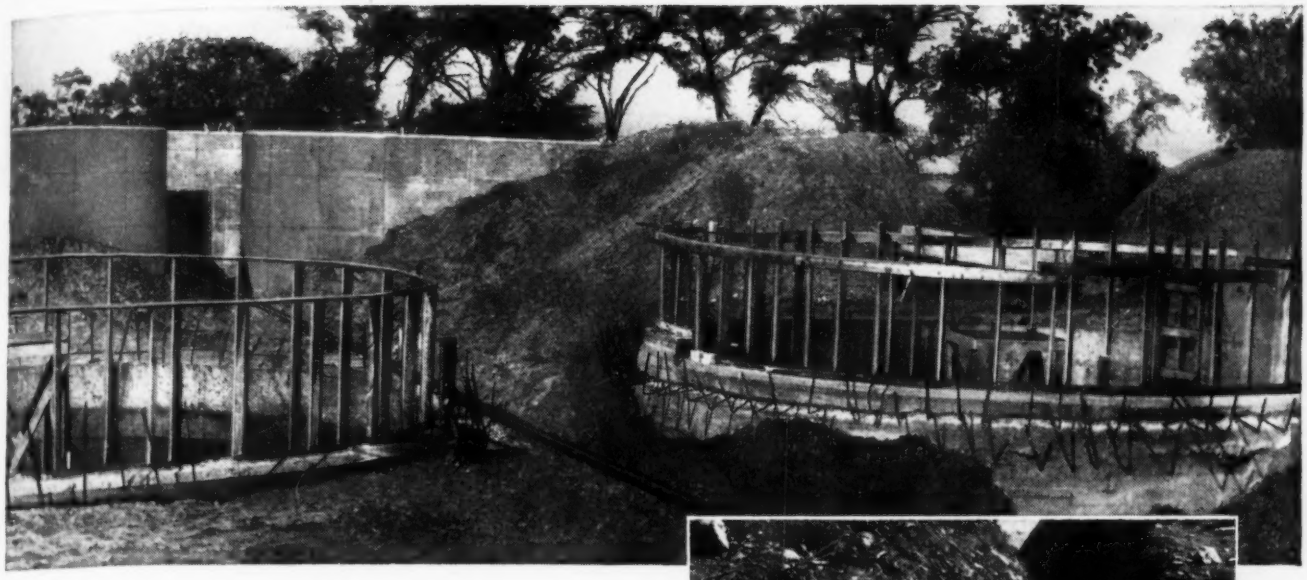
CHAIN BELT REX COMPANY — SANITATION EQUIPMENT

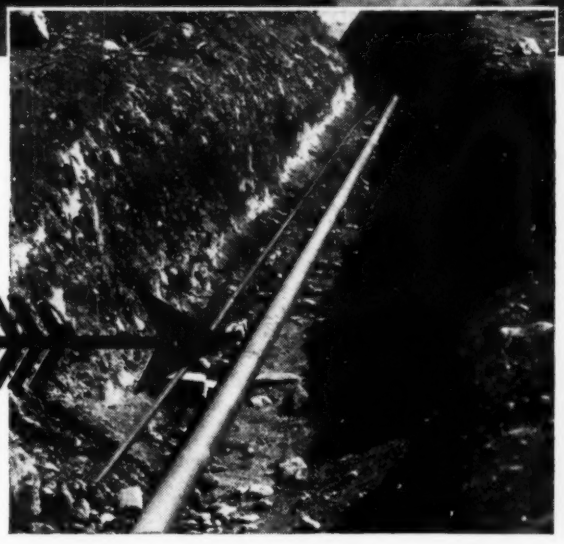


Since 1849 EDDY For Long Service

EDDY
VALVE COMPANY
A Subsidiary of James B. Clow & Sons
WATERFORD, NEW YORK

★ The National Board of Fire Underwriters recommend spacing valves every 500 to 800 feet on underground water distribution lines. Eddy cutting-in valves and sleeves with their mechanical joints save time . . . make the job easy and simple to perform on existing pipe lines. No caulking experts and no lead-melting equipment are needed. ★ After excavation and following removal of a section from the water main or hydrant stub, two men and a ratchet wrench can complete the job in twenty-one minutes—with all joints "bottle tight" under pressure. Work can be done in any kind of weather . . . in a flooded trench . . . fast and sure should emergency require. ★ Stock up now with Eddy cutting-in valves and sleeves and be ready for speedy, on the spot installations as circumstances may permit. Valves meet AWWA specifications . . . are available in sizes 3 to 12 inches . . . for use on both sand cast and centrifugally cast iron water pipe.





Utilizing Sewage Gas means Corrosion so this plant used Byers Wrought Iron

In the new Sewage Treatment plant at Fall River, Massachusetts, plans called for using sewage gas to heat two of the new buildings. Hayden, Harding & Buchanan, the engineers, recognized that the economies from this by-product utilization would be cancelled out by excessive maintenance in the gas handling lines—unless proper steps were taken to combat the severe corrosive conditions. They used a time-tried method, by specifying "wrought iron". Byers black wrought iron pipe, in sizes from 1 inch to 4 inch, was installed. The general contractor on the project was Wyner-Gil Company, and plumbing and heating was handled by J. F. McGlame Company.

Conveying sewage gas is always a real problem, because of its extremely corrosive character. Such gas contains a substantial proportion of carbon dioxide, as well as hydrogen sulfide, and is moist. This sets the stage for acid formation, and aggressive corrosive action. Wrought iron is highly resistive to this type of corrosion, and it has been used by leading engineers in a large number of the nation's most modern plants.

Wrought iron's unique character is responsible for its excellent service qualities. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack. The fibers also help anchor the initial protective scale, which shields the underlying metal.

Our bulletin, "Wrought Iron for sewage treatment and disposal installations", gives a concise but comprehensive story of how wrought iron is reducing maintenance in dozens of services. Ask for a complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N. Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

ASK UTICA, NEW YORK

96%

CAST IRON PIPE

K ABOUT CAST IRON PIPE!

In 1849—one hundred years ago—Utica laid her first 6-inch cast iron pipe. Of all the 6-inch cast iron pipe laid from that date, 98.2% is still in service.

In the same year, Utica installed her first 12-inch cast iron pipe and 99% of all the 12-inch cast iron pipe laid from that date is still in service.

Utica is one of the cities included in the survey of "Survival and Retirement Experience with Water Works Facilities", including cast iron water mains, conducted under the auspices of the American Water Works Association, the New England Water Works Association and the Institute of Water Supply Utilities. The recently published report of the findings of the survey shows that 96% of all 6-inch and larger cast iron water mains ever laid since 1817 in 25 representative cities are still in service.

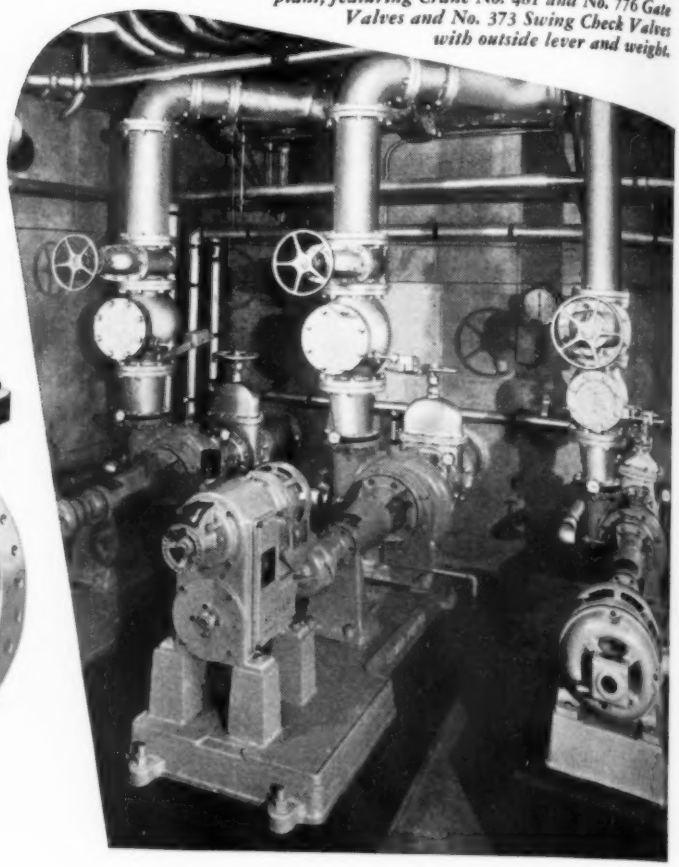
Utica's experience with cast iron water mains, therefore, while remarkable, and eminently satisfactory to her taxpayers, is not exceptional.

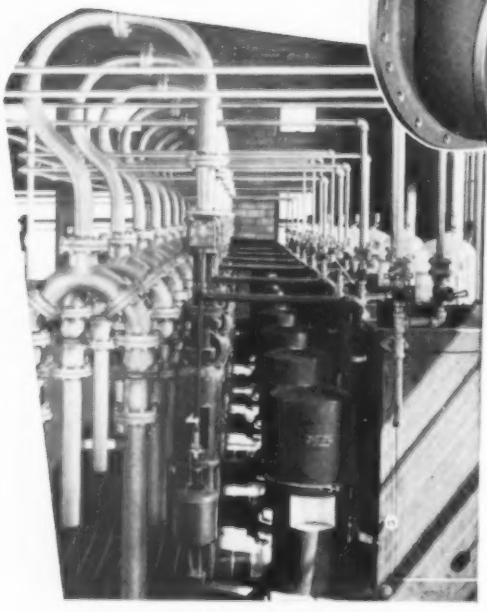
We shall be glad to send on request a copy of our brochure "Survival and Retirement Experience with Cast Iron Water Mains", reprinted by permission. Address Thomas F. Wolfe, Engineer, Cast Iron Pipe Research Association, 122 South Michigan Avenue, Chicago 3, Illinois.

SERVES FOR CENTURIES

FOR MODERATE PRESSURES *not requiring the use of "standard" weight valves . . . Crane recommends Light Standard Iron Body Double Disc Gate Valves. Ideal for service conditions too severe for Low Pressure valves. Working pressures, up to 100 pounds cold water, oil or gas, non-shock. Brass trimmed with flanged or hub ends; non-rising stem or O. S. & Y. Sizes: 4 to 36-in. See your Crane Catalog, p. 125.*

SUCTION AND DISCHARGE *lines in small town disposal plant, featuring Crane No. 481 and No. 776 Gate Valves and No. 373 Swing Check Valves with outside lever and weight.*





PIPING TO CHLORINATORS *in a large sewage treatment plant. Crane furnishes all valves, fittings and pipe bends.*

a dependable valve

—for every control point in your system. That's what you can count on when you specify valves from the complete Crane line. For in water services of *every* type, Crane valves have compounded a record for dependable performance that is unsurpassed in this field.

Crane Quality, in valves as in fittings, is your assurance of efficient, trouble-free operation under all conditions of service—a fact that minimizes repair and replacement costs. No wonder so many communities prefer to rely on Crane, for more than 90 years a leader in the development of reliable flow control equipment.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Nation-Wide Service Through Branches and Wholesalers

VALVES · FITTINGS · PIPE

CRANE

PLUMBING AND HEATING

PLUS Power.. Speed.. Mobility

FEATURING . . .

1½ Cu. Yd. Capacity
Hydraulic Bucket Control
Hydraulic Down-Pressure
Rear-Wheel Power Steering
Automatic Tip-Back Bucket
Four Forward Speeds
2 to 16 mph
Four Reverse Speeds
3 to 24 mph

Write for Free Catalog

on the Model HM or on other sizes of Hough Payloaders—the 1¼ cu. yd. Model HL, the ¾ cu. yd. Model HF, the 10½ cu. ft. Model HA.

Here is an entirely new experience in earthmoving — an entirely new conception of the work capacity and job capacity of a rubber tired tractor shovel. Here is an entirely new tractor shovel—revolutionary in design—revolutionary in performance.

Big and powerful, the 1½ Yd. Model HM PAYLOADER provides tremendous digging power and ground-gripping traction for tough going in rock, sand, mud, muck or *any* terrain. With 4-Wheel Drive on large rubber tires it provides traction comparable to a crawler tractor—plus more speed, greater mobility, easier maneuverability and *far less maintenance expense.*

Compact design, short wheel base and power boosted rear wheel steering enable the HM to operate in close quarters. It has four speeds in either direction and quick acting forward-reverse control. Double acting finger-tip hydraulic control raises — lowers — dumps and closes the bucket . . . provides powerful down pressure for tough digging. Get the complete story on this new PAYLOADER from The Frank G. Hough Co., 752 Sunnyside Avenue, Libertyville, Illinois.

SAY "HUFF"

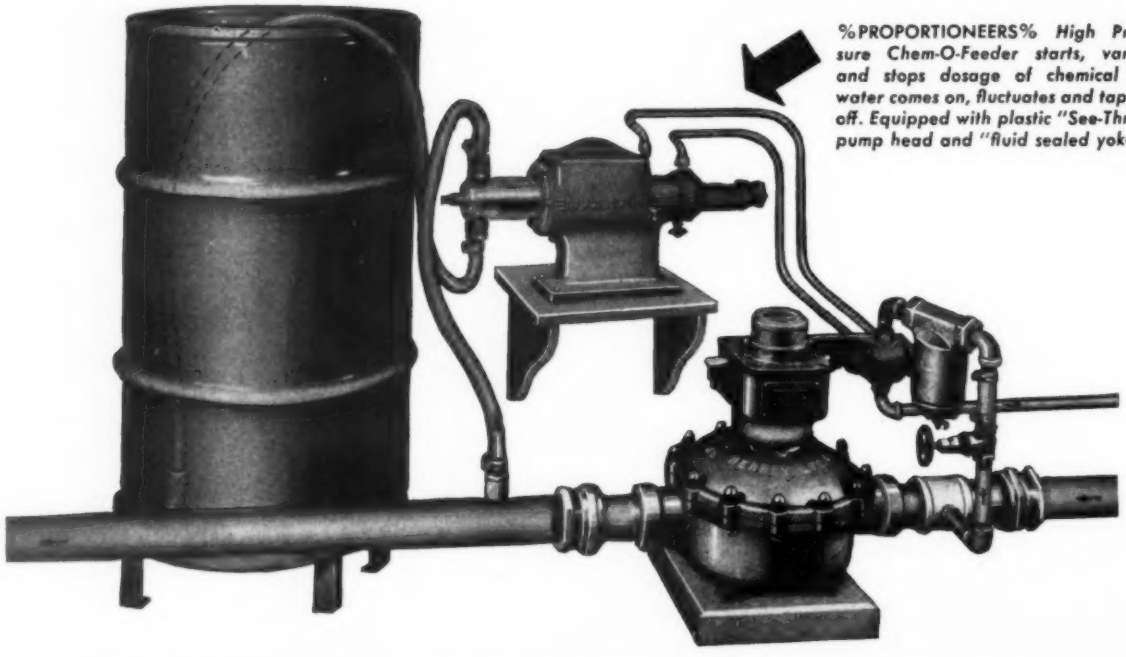
HOUGH
PAYLOADER

Manufactured by THE FRANK G. HOUGH CO.

WATER WORKS MEN *are smarter than people!*

MOST people think any clear water is safe to drink but water works men know better! They realize that water to be safe must be properly chlorinated—and they won't tolerate dangerous undertreatment or the disagreeable taste resulting from overtreatment.

%Proportioneers% Automatic and Proportional High Pressure Chem-O-Feeder has long been the favorite of wise water works men . . . paced by standard water meter, it automatically injects just the right amount of treating chemical at just the right time. No external source of power is required: the Chem-O-Feeder is hydraulically driven by the water in the main itself. Even when pressures are as high as 200 lbs. per sq. in. and the flow varies from minute to minute, the Chem-O-Feeder provides precise, dependable water treating. Other %Proportioneers% units are available to meet every operating condition. Information on request.

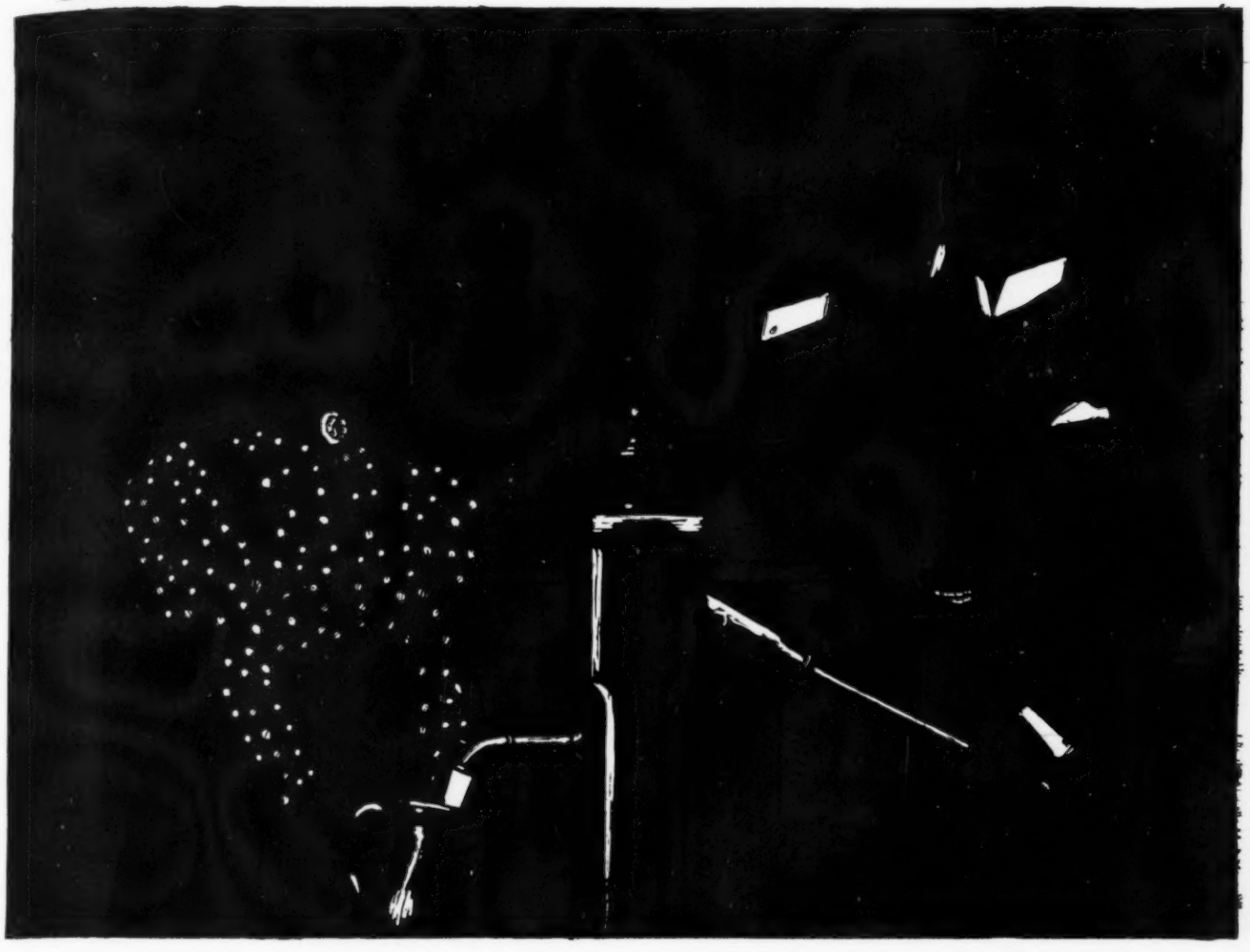


%PROPORTIONEERS% High Pressure Chem-O-Feeder starts, varies and stops dosage of chemical as water comes on, fluctuates and tapers off. Equipped with plastic "See-Thru" pump head and "fluid sealed yoke".

% PROPORTIONEERS, INC. %

9 N. CODDING ST., PROVIDENCE 1, R. I.

"Tastes kind of funny lately, Ma?"



DURING the past half-century, sanitary engineering has made great strides in combatting diseases caused by pollution of water sources. The year 1899, when our Company was established, also marked the development of sewage treatment in America. Today, more than 6,000 sewage treatment plants are in operation serving over half of our urban population.

The growth of water supply and gas service during this period has been equally remarkable. Today, 12,000 public water supply systems serve 85 million people. More than 20 million homes are furnished with gas for cooking and heating.

It has been our privilege to share in the progress of these public services by providing cast iron pressure pipe, for water, gas and sewer mains, and for sewage treatment and water purification plants. Better pipe today, naturally, than 50 years ago—stronger, tougher, more uniform in quality. An old-time pipe founder would be amazed by the improved casting methods, production standards and quality controls in operation at our several foundries.

U.S.
CAST IRON
PIPE

NOW ONE METER DOES THE WORK OF TWO MAKING AND SAVING MONEY THREE WAYS...

ONE— the initial cost is less than the corresponding size of a Compound Meter.

TWO— the Style 3 Meter is more consistently accurate, giving better revenue.

THREE— being of more simple construction, the Style 3 Meter maintains its accuracy longer; and repairs are easier.

NEPTUNE METER COMPANY • 50 West 50th Street • NEW YORK 20, N.Y.
Branch Offices in Chicago, San Francisco, Los Angeles, Portland, Ore., Denver, Dallas, Kansas City, Louisville, Atlanta, Boston.
NEPTUNE METERS, LTD., Long Branch, Ont., Canada

200

STYLE Trident 3

1½" and 2"

Simplifies Your Metering

WATER & SEWAGE WORKS

VOL. 96. NO. 3 MARCH, 1949

A Gillette Publication

FORCED CIRCULATION TYPE HOT WATER HEAT EXCHANGERS FOR DIGESTION TANK HEATING

By
JOHN J. BAFFA
Consulting Engineer
NEW YORK CITY

IN RECENT years considerable attention has been given to heating of sludge digestion tanks by means of heat exchange apparatus located externally with respect to the tanks. This development has been a natural result of difficulties with the conventional fixed interior heating coils. The major difficulty encountered with the fixed interior heating coils has been constantly decreasing heat transmission efficiency due to sludge caking and the resultant necessity to dewater tanks for cleaning, thus interrupting operations and in some instances involving considerable labor costs.

Various methods of external heating of digesters have been described in sewage works literature and include the following:

a) Addition of steam to raw sludge.
b) Contact heating of sludge in separate heating tanks or in the digesters themselves in which the sludge is brought into direct contact with intensely hot combustion products.
c) Forced circulation type hot water heat exchangers in which the sludge to be heated is circulated through pipes immersed in a hot water bath.
d) Forced circulation type hot water heat exchangers through which both the hot water providing the heat and the sludge to be heated are circulated by pumping and travel through the heat exchanger in opposite directions.

The Author

Of the various methods of external digester heating the forced circulation type hot water heat exchangers have found the widest application. A number of installations have been completed and a considerable number are projected.

In view of the number of such installations which are, or may soon be, in operation, it is the purpose of this article to set forth briefly some fundamental considerations of the theory and practical use of hot water heat exchangers with the thought that such information may be of value to engineers and plant operators in securing and making available to the sanitary engineering profession, operating data on heat exchanger operation.

Equipment Available

Illustrations of some commercial types of heat exchangers which are available are shown in Figs. 1 to 4 incl.

Fig. 1 shows a hot water bath type combination heater and exchanger. The left hand side of the apparatus comprises gas and oil firing units arranged with fire tube flues to heat the contained water bath which transmits heat to the sludge. Return bends on the sludge tube nest are seen at the right hand side of the apparatus. The heat transmission takes place through the walls of the horizontal sludge tubes as the sludge is recirculated therein by means of an external pump. Return bends on the sludge tubes are also located at the rear of the apparatus. All of the return bends are removable to allow straight through cleaning of the sludge tubes. In addition, the sludge tubes can be completely removed for cleaning. The four pipe connections visible at the right comprise two sludge inlets and two sludge outlets. At the rear of the unit may be seen hot water connections to the water bath from an engine cooling system. The controls for the unit provide for automatic heating of the water bath by the firing units when insufficient heat is available from the circulating hot water from the engine cooling system. The exhaust fan at the upper left provides for control of air for combustion and for exhausting of products of combustion of the firing units. The butterfly valve at the fan suction allows withdrawal of air from the room or chamber in which the apparatus is located. Vented hot water expansion tank is seen behind the exhaust fan.

Therefore, the unit shown in Fig. 1 can operate as a stationary water bath type of exchanger with only

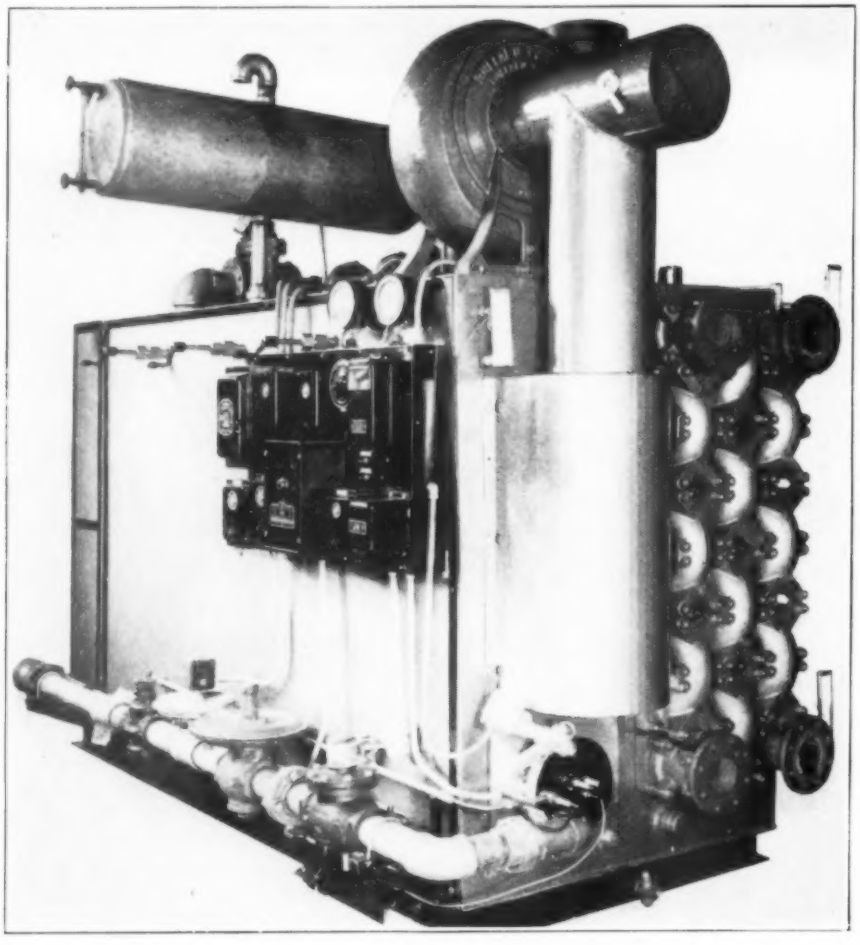


Fig. 1. P.F.T. Hot Water Bath Type Heater and Heat Exchanger
(With twin sludge inlet and outlet connections in front and connections for circulating engine cooling water in rear.)

thermal circulation of the hot water bath and the sludge in motion through the sludge tubes or it can operate with forced circulation of the hot water as well. For the unit shown, the hot water circulation would be caused by a remotely located engine jacket water pump and thus provide for heat recovery from the operation of a diesel engine or gas engine or dual fuel engine.

Fig. 2 shows a similar type unit with single sludge inlet and outlet connection in front and a hot water circulating pump on top. The hot water circulating pump provides for circulating the hot water bath through a building heating system. During seasons when building heat is not required the circulating pump is inoperative and thermal circulation of the water bath around the sludge tubes is made available by opening of an interior thermal circulating valve. The firing units automatically supply heat to maintain the water bath temperature on the fire tube side between a predetermined upper and lower limit. For all practical purposes of calculation, the water bath on the sludge tube side can be considered to be maintained at a constant average temperature.

Fig. 3 shows front and rear views of a forced circulation counter current flow type hot water heat exchanger. Sludge and hot water connections are on the front of the unit. The hot water enters the exchanger at the vertical connection at the upper right and leaves at the side outlet connection at the lower left. The sludge to be heated enters the exchanger at the front connection at the lower left and leaves the exchanger at the front connection at the upper right.

The apparatus comprises essentially a nest of circular tubes and shells. Each tube is concentric with its shell. The sludge travels through the tubes and the hot water travels through the annular space between tube and shell. Baffled manifolds are provided for sludge and water at the front end of the apparatus and integrated with their respective inlet and outlet connections.

Fig. 3 (lower half) shows the rear view of the apparatus with insulated cover removed and one of the return bends removed. The apparatus is so arranged that shells and tubes can be completely removed for cleaning.

The sludge to be heated is pumped through the unit by means of an external sludge pump. Hot water is also circulated by pumping. Heat is supplied to the hot water by an external boiler unit or from engine jackets and exhaust gases.

The units shown in Fig. 1, 2, and 3 are designed to eliminate the possibility of contamination of circulating hot water or water bath by the circulating sludge.

Fig. 4 (right) illustrates a countercurrent flow type spiral heat exchanger with front door opened as if for cleaning. Fig. 4 (left) shows the same unit with the door closed and ready for operation. These units differ from those shown in Figs. 1, 2, and 3 in that no pipes or tubes are used for the heating surface. The heating surface comprises two plates rolled up to form concentric spirals. The sludge and hot water flow counter currently in the two spaces between the plates.

The sludge enters the unit at the connection shown at the top to the right of the center and leaves the unit through a connection at the rear center. The hot water enters the unit at the rear center and leaves at the connection at the top to the left of the center. Sludge is pumped through the unit by means of an external pump as is the hot water. Heat is supplied to the hot water by means of an external boiler, or if heat recovery from engine cooling water is desired, then heat is supplied from engine jackets and exhaust gases.

All of the units shown in Fig. 3 and 4 are available up to capacities as high as 1,500,000 Btu. per hour and higher and water bath type units are available up to 1,100,000 Btu. per hour. All are installed on the basis of recirculating a portion of digester contents through the units continuously.

Theory

In Fig. 5 is shown the temperature and direction of flow diagram for the counter current forced circulation type heat exchanger through which both the hot water and sludge are in motion and flow in opposite directions on opposite sides of metal barriers. The hot water enters the heat exchanger at temperature T_1, gives up heat to the sludge and leaves the exchanger at lower temperature T_2. The sludge enters the heat exchanger at lower temperature T_4, absorbs heat and leaves the exchanger at higher temperature T_3.

In Fig. 6 is shown the temperature and direction of flow diagram for the water bath type of heat exchanger in which the hot water is stationary except for thermal circulation and is automatically maintained at an average temperature and surrounds the metallic pipes through which the sludge to be heated is circulated. The sludge flow is from right to left. The sludge enters the exchanger at cold temperature T_4 and leaves the exchanger at heated temperature T_3.

In the heat exchanger apparatus, the heat transmission from the hot water to the sludge takes place through the metallic barrier separating them chiefly by convection and conduction. The rate of heat flow through the metallic barrier separating the two fluids will depend upon—

1) The contact area available for the transfer of heat
2) The difference in temperature between the hot water and the sludge
3) The overall conductance of the metal barrier, films and deposits

Each of the three above factors directly affects the total rate of heat transfer which may be formulated as follows:

$$H = U \times A \times T_m \qquad \text{(Eq. 1)}$$

where

H = Total rate of heat flow in Btu. per hr.

U = Overall rate of heat transfer for the entire apparatus or overall conductance in Btu. per hr. per sq. ft. per deg. F.

A = Surface area available for heat transfer in sq. ft.

Tm = Mean effective temperature difference between the hot water and the sludge in deg. F.

Fig. 7 shows the effect on the temperature gradient of films, metal, corrosion scale, and deposits while transferring heat from the hot water to the sludge through a metal barrier. The overall conductance U, of the metal barrier including metal, films, scale, and deposits is formulated as follows:

$$U = \frac{1}{\frac{t}{K} + \frac{1}{k_1} + \frac{1}{k_2} + \frac{1}{k_3} + \frac{1}{k_4}} \qquad \text{(Eq. 2)}$$

where

K = Conductivity of the metal in Btu. per hr. per sq. ft. per deg. F. per in. thickness of metal.

t = Thicknes of metal wall in in.

$k_1\ k_2\ k_3\ k_4$ = Conductances of the surface films and corrosion scales or deposits expressed in Btu. per hr. per sq. ft. per deg. F. When a scale or deposit is absent its resistance factor such as $\frac{1}{k_4}$ becomes zero.

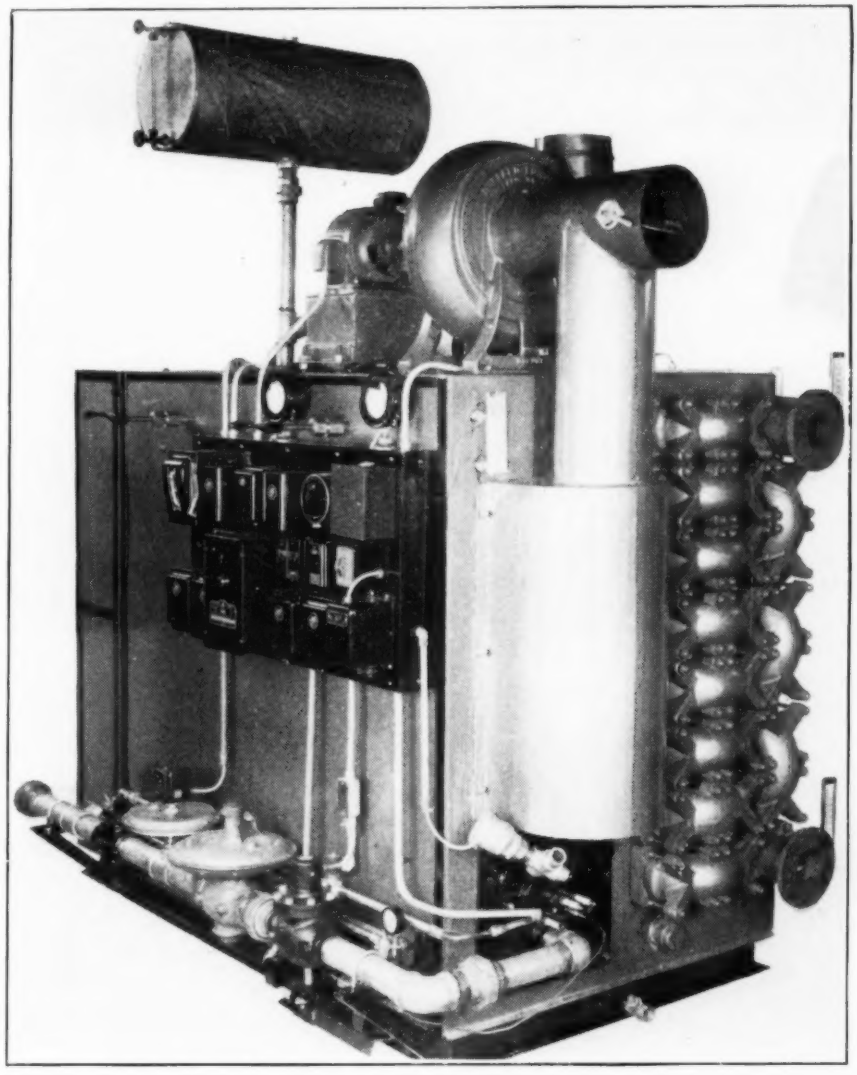


Fig. 2. P.F.T. Hot Water Bath Type Heater and Heat Exchanger

(With single sludge inlet and outlet connections in front and circulating hot water pump on top.)

The conductance of scale deposits and films can be combined into a term called U_k or the overall film conductance and expressed in Btu. per hr. per sq. ft. of contact surface per deg. F.

$$U_k = \frac{1}{\frac{1}{k_1} + \frac{1}{k_2} + \frac{1}{k_3} + \frac{1}{k_4}} \qquad \text{(Eq. 3)}$$

Equation 2 therefore can be written as follows:

$$U = \frac{1}{\frac{t}{K} + \frac{1}{U_k}} \qquad \text{(Eq. 4)}$$

Otherwise expressed, this means that the overall conductance U of the contact surface separating the hot water and the sludge depends not only upon the kind of metal and the thickness of it but also upon the film, scale and deposit conductances.

The film scale and deposit conductances are a function of their nature and thickness which in turn are a function of the degree of turbulence of the flow of the two fluids under consideration, and their temperature differences.

The greater the turbulence of the flow the greater is the amount of heat convected to or from the heating surface because many of the fluid particles with component velocities toward the heating surface break through the surface film and carry heat to or from the separating barrier. In addition, relatively high velocities tend to minimize deposition and exert a scouring effect on scales and deposits.

It follows for the type of apparatus under consideration that the detrimental sludge film effects, common to digestion tank coils, are lessened at proper sludge velocities, and higher hot water temperatures are permitted than would be allowable with the conventional interior heating coils. On the other side of

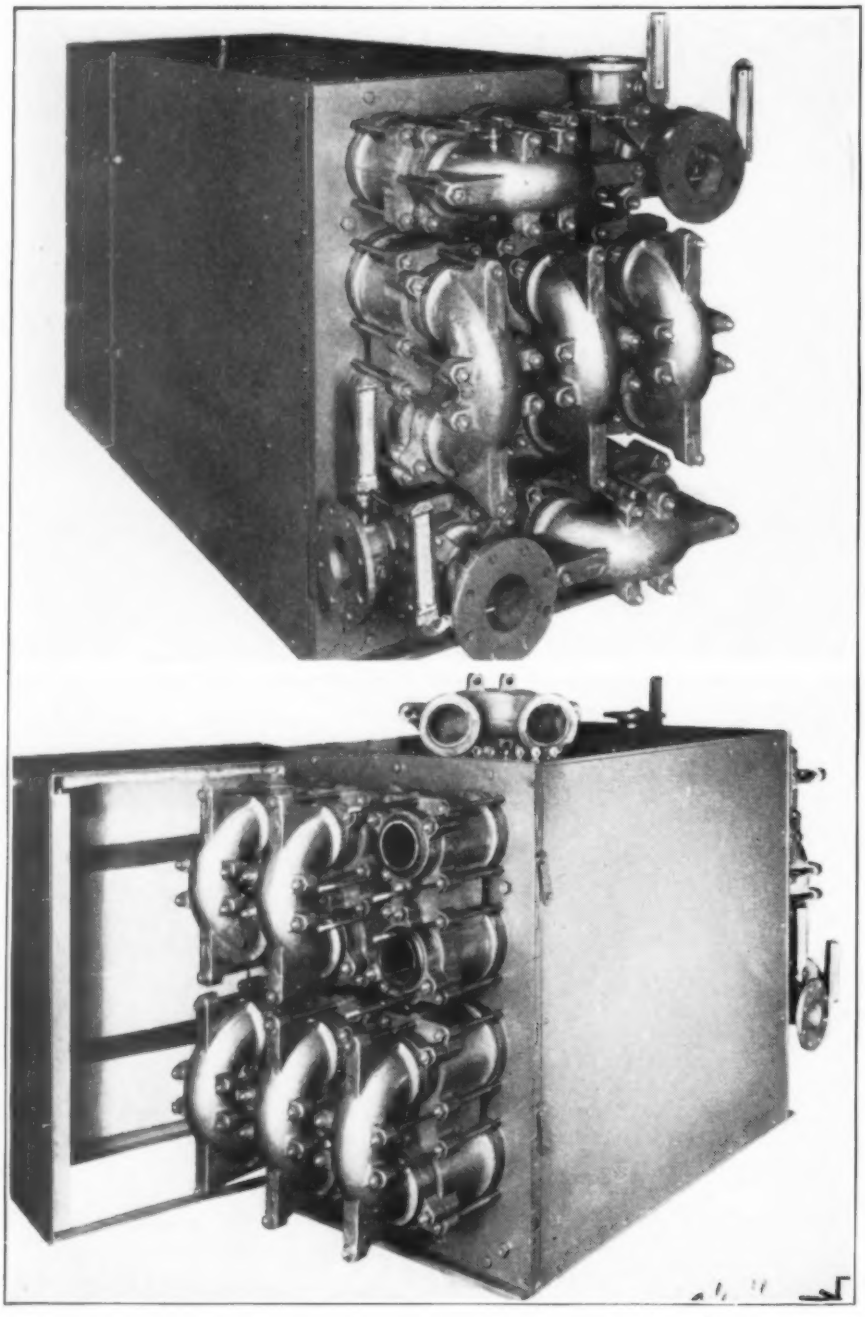


Fig. 3. P.F.T. Counter Current Flow Type Forced Circulation Hot Water Heat Exchanger
(Top—Front View. Bottom—Rear view with casing removed and one elbow removed ready for cleaning.)

the ledger with respect to high velocities is the consideration of head loss through the apparatus.

Thus the overall co-efficient of heat transmission U for the heat exchanger apparatus is also affected by the velocities of flow of the hot water and the sludge.

Experience with heating coils in digesters indicates that the metal resistance t/K is slight and has been neglected in computation since it has been overshadowed by the sludge film resistance. The writer believes, however, that the effect of metal resistance will assume somewhat greater importance in external heat exchanger applications because of structural necessity for thicker metal barriers and deposition and film effects will be lessened by turbulent flows through heat exchange apparatus.

Table I indicates the thermal conductivities of some metals and alloys such as might be used in heat exchangers.

In the choice of metal and metal thickness for heat exchangers, due thought should be given to corrosion and abrasion resistance, structural characteristics and conductivity in relation to sludge and water temperatures involved. The likelihood of some metals forming insoluble corrosion products is also of importance.

Measurement of Performance

To evaluate the performance of a heat exchanger, a satisfactory unit of measurement is the determination by test of the overall co-efficient of heat transmission U for the apparatus as a whole under a particular set of conditions.

Overall Co-Efficient of Heat Transmission

The total heat transmitted by the entire heat exchanger apparatus per unit of time can be expressed as

Table I
CONDUCTIVITY OF METALS
(For Temperatures of 32° F. to 212° F.)

Metal	Conductivity Btu per hr. per sq. ft. per deg. F. per in. of thickness
Wrought Iron	370
Mild Steel (S.A.E. 1020)	460
Nickel	420
Red Brass (85-15)	1100
Silicon Bronze	225
Ingot Iron	470
Monel	180
Stainless Steel (types 304, 316, 321)	105
Aluminum (2s)	1570
Pure Copper	2640

shown in Equation No. 1, where U is considered to be the overall co-efficient of heat transmission for the entire heat exchanger apparatus and is expressed in Btu. per hr. per sq. ft. of exchanger heating surface per deg. Fahrenheit.

The area of contact surface can be obtained from the equipment manufacturer or measured and computed thus providing a value for "A" in Equation No. 1. For curved contact areas of ordinary thickness the average area of water and sludge contact surfaces provides sufficient accuracy.

Referring to Fig. 5 the value for H in Equation No. 1 can be obtained as follows:

$$H = (T_3 - T_4) \times W_s \times C_s \quad \text{(Eq. 5)}$$

where

T_3 = Sludge outlet temperature in °F
T_4 = Sludge inlet temperature in °F.
W_s = Pounds of sludge flowing per hour
C_s = Mean specific heat of sludge (usually taken as 1.0)

If there are no external losses, the heat absorbed by the sludge should equal the heat given up by the hot water.

Therefore,

$$H = (T_1 - T_2) \times W_m \times C_m \quad \text{(Eq. 6)}$$

where

T_1 = Hot water inlet temperature
T_2 = Hot water outlet temperature
W_m = Pounds of water flowing per hour
C_m = Specific heat of water (taken as 1.0)

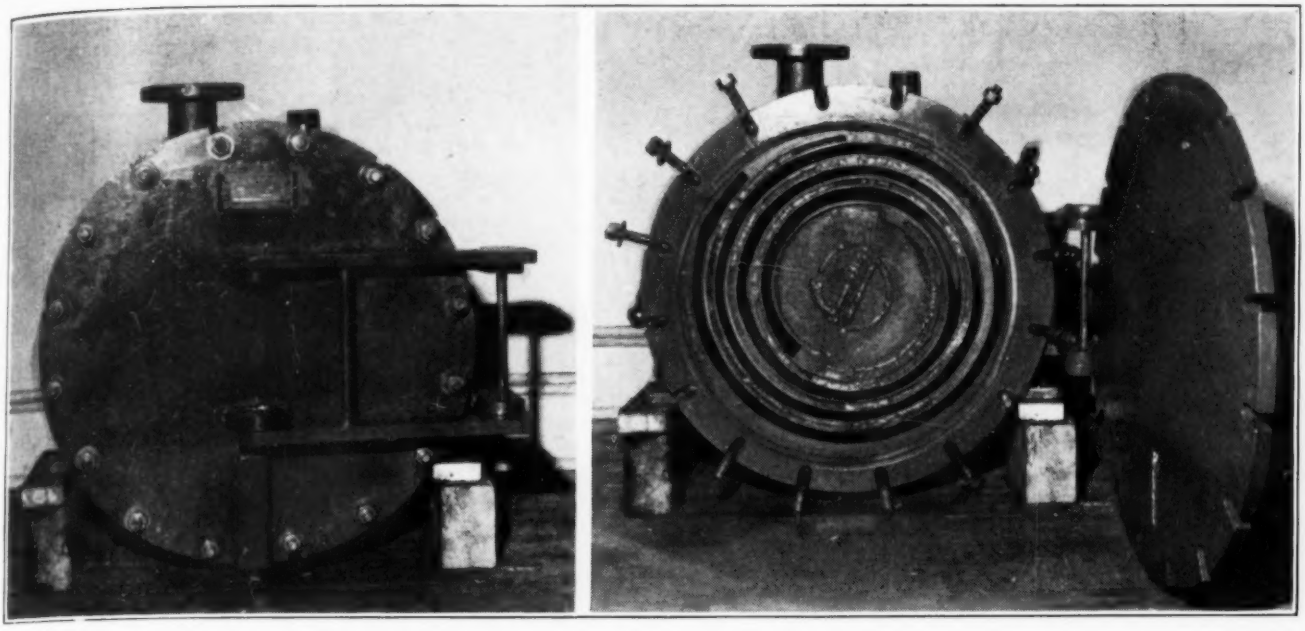


Fig. 4—Dorr Co. Counter Current Flow Type Spiral Heat Exchanger
(Left—With front door closed. Right—With front door open, showing interior.)

Under actual test conditions, the heat given up by the hot water is always somewhat greater than that absorbed by the sludge and the difference represents radiation loss. To compute the value of the overall coefficient of heat transmission the amount of heat calculated by Equation No. 5 should be used since there is usually a small amount of radiation loss.

It will be noted from Fig. 5 and 6 that the variation in temperature of the sludge while traversing the heat exchanger is not a straight line so that the use of an arithmetic mean temperature difference for the value of T_m would not be exact. Commonly accepted procedures are to use the arithmetic mean temperature difference when T_a and T_b are close together and the logarithmic mean when T_a and T_b are far apart. For all practical applications of hot water heat exchangers for sludge heating the arithmetic mean temperature difference is adequate.

It can be seen from Fig. 5 and 6 that T_a equals the temperature of entering hot water minus temperature of heated sludge leaving the exchanger or

$$T_a = T_1 - T_3 \qquad \text{(Eq. 7)}$$

T_b equals temperature of cooled water leaving the heat exchanger minus temperature of cold sludge entering the heat exchanger or

$$T_b = T_2 - T_4 \qquad \text{(Eq. 8)}$$

The arithmetic mean temperature difference is

$$T_m = \frac{T_a + T_b}{2} \qquad \text{(Eq. 9)}$$

The logarithmic mean temperature difference is

$$T_m = \frac{T_a - T_b}{\text{Log}_e \frac{T_a}{T_b}} \qquad \text{(Eq. 10)}$$

The logarithmic mean temperature difference provides extreme accuracy which is not warranted when accuracy of observations of this type is considered. If desired, however, it is easily computed by use of a table of natural logarithms.

Thus with all values known, except U, Equation 1 is easily solved for U.

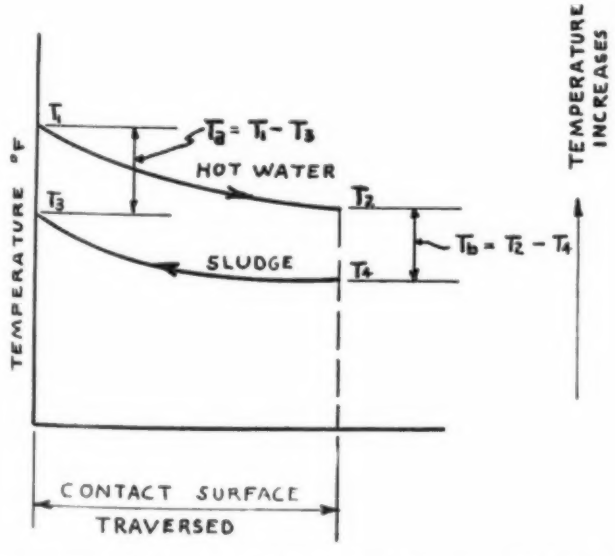


Fig. 5. Counter Current Flow Type of Heat Exchanger—Direction of Flow and Temperature Diagram.

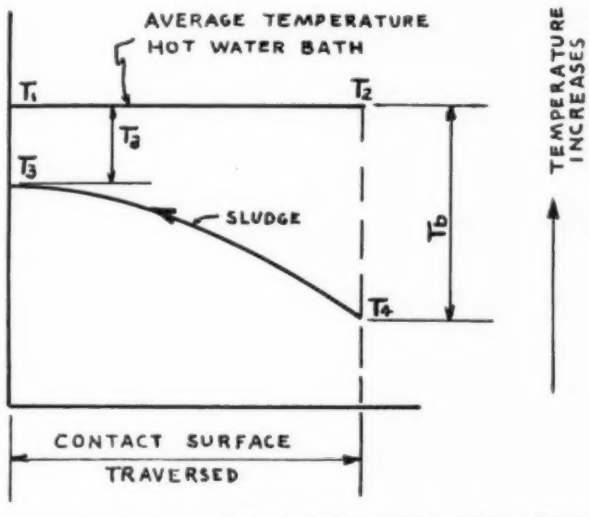


Fig. 6. Water Bath Type of Heat Exchanger—Direction of Flow and Temperature Diagram.

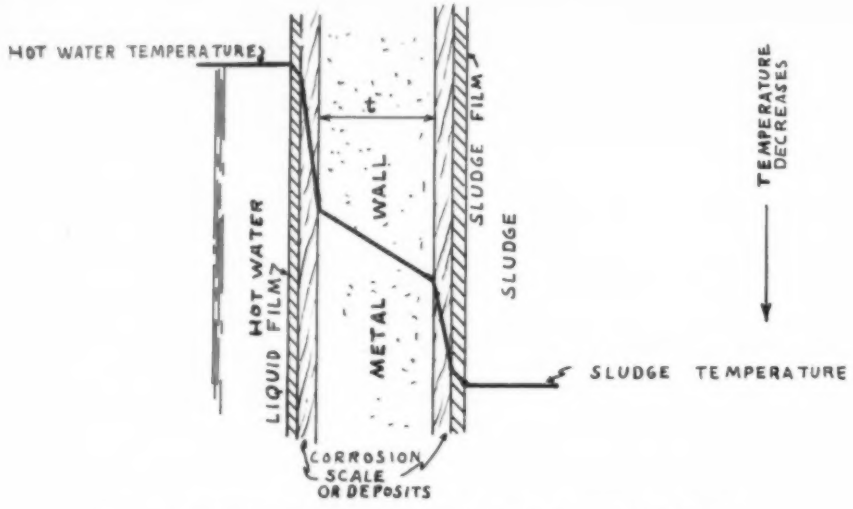


Fig. 7. Temperature Gradient Through Heat Transmitting Surface.

Therefore, if a new or just cleaned heat exchanger is tested with measured rates of sludge and water flow and entrance and exit temperature of both hot water and sludge are read, the overall co-efficient of heat transmission for the exchanger may be computed. After a period of operation the test can be made again at the same rates of sludge and hot water flow and the effect of films and scale can be evaluated. If flow rates and temperatures are varied, curves of heat transmission for various flows and temperatures can be obtained for study to determine optimum efficiency conditions.

Example

Assume that a performance test was run on a heat exchange apparatus similar to those shown in Fig. 3 and 4 and the following average for test run data was obtained:

Hot Water Flow..... 62 gpm.
Sludge Flow..... 75 gpm.
Hot Water Inlet..... Temperature (T_1) 150° F.
Hot Water Outlet..... Temperature (T_2) 136° F.
Sludge Inlet..... Temperature (T_4) 89° F.
Sludge Outlet..... Temperature (T_3) 100° F.

Heating Contact Surface..... 83.2 sq. ft.

Heat Absorbed by Sludge =

75 gpm. × 8.34 lb./gal. × 1.03* × 60 min./hr. × (100 − 89)°F. × 1 btu./lb./°F. = 425,000 btu./hr.

*Specific Gravity of Sludge

Heat Given up by Hot Water =

62 gpm. × 8.34 lb./gal. × 60 min./hr. × (150 − 136)°F. × 1 btu./lb./°F. = 434,000 btu./hr.

Radiation Loss =
(434,000 − 425,000) = 9000 Btu. per hr. 9,000/425,000 = 2.1% Radiation Loss

$T_a = 150°F - 100°F = 50°F$
$T_b = 136°F - 89°F = 47°F$

Mean Temp. Diff. $T_m = \frac{50 + 47}{2} = 48.5°F$

Overall Coefficient of Heat Transmission

$$U = \frac{H}{A \times T_m} = \frac{425{,}000}{83.2 \times 48.5} = 105 \text{ Btu. per sq. ft. per hr. per deg. F.}$$

The above figures are for purposes of illustration only and do not refer to any particular apparatus. Calculations are by slide rule.

For the water bath type of exchanger with firing units in operation while sludge is recirculated, computations for determination of U would be similar except that hot water inlet and outlet temperatures would both be the same as per Fig. 5 and would comprise the average temperature of the water bath on the sludge tube side during the test run. This average temperature would have to be obtained by averaging temperatures of the top and bottom of the water bath on the sludge tube side. Another method of testing would be to turn off the firing unit and determine drop in temperature of water bath for measured addition of heat to sludge. The determination and expression of "fuel to sludge" efficiency would be of considerable interest in connection with the water bath unit.

Designing engineers are urged to provide for metering and pressure measurement facilities and properly located thermometers in their designs so that the obtaining of operating data will be facilitated and thus data will be provided for future designs and for study to improve plant performance and save heating dollars.

Acknowledgement

The writer wishes to express his appreciation to Paul Cerny of the Pacific Flush Tank Co. and W. A. Darby of the Dorr Co. for their courtesy in providing photographs and data for the equipment described.

References

1) Miles, Henry J.—Evaluation of Methods of Heating Sludge. *Sew. Wks. Jour. 19:* 161-169 (1947) (Including discussions by Willem Rudolfs, A. M. Rawn, Vinton W. Bacon, Harvey F. Ludwig)

2) Wittwer, Norman C.—Theory and Practice of Sewage Sludge Digestion Tank Heating. *Water Works and Sewerage 90:* 229-239 (1943)

3) Applied Thermodynamics, Virgil Moring Faires—The Macmillan Company—New York, 1947

A.W.W.A. CO-OPERATES WITH FEDERAL AGENCY

On January 26 representatives of the A.W.W.A. met with the National Security Resources Board for discussion of public water supply and national preparedness.

Out of this conference came the naming of permanent planning committees of manufacturers and water utility managers which will work with the Water Utility Office of the N.S.R.B. in planning the strengthening of water supply systems and providing for supplies of critical materials in short supply, in order that such much needed strengthening of water supply facilities can be realized and effective priority and allocation plans can be developed in advance of need, should there be such.

On January 24 and 25 a group of technical specialists in the water supply and sewerage field and state sanitary engineers held a joint conference in Washington sponsored by the Pollution Branch of the Atomic Energy Commission. The objective was that of dissemination of confidential information to those whose responsibility it will be to combat the results of water and aerial contamination from atomic energy production or possible atomic bombing.

A.W.W.A. BOARD ACTIONS

Taken at Three-Day Meeting in Chicago

ON January 16-17-18 the A.W.W.A. Board of Directors, representing a membership of more than 7,000 at the year end, met at the Hotel Stevens in Chicago to

President (Incumbent)
Linn H. Enslow
New York

President (Nominate)
A. P. Black
Gainesville, Fla.

consider and approve a budget for 1949 operations of the Association, elect officers and three honorary members, vote awards to two members, hear committee reports, plan the future work and activities of the Association, and discuss the technical program and plans for the 1949 Annual Convention to be held at Hotel Stevens in Chicago, May 30-June 3.

It is again noteworthy that of the 39 members of the Board all were present at the meeting but two, one being the member from Cuba and the other, A. C. Decker (Ala.-Miss. Sect.), prevented from attending due to illness.

The following were chosen as the official nominees of the Board for offices during the year which begins with the closing of the 1949 Convention and ends with the close of the 1950 Convention. These official nominations become effective as automatic elections on March 1, 1949, unless contenders are nominated by the membership-at-large.

For President
A. P. Black, Prof. of Chemistry
Univ. of Florida
Gainesville, Fla.

For Vice-President
W. Victor Weir, President
St. Louis County Water Co.
University City, Mo.

For Treasurer
W. W. Brush, Editor
Water Works Engineering
New York, N.Y.

HONORS AND AWARDS

The Board elected the following members to Honorary Membership:

Thomas L. Amiss, Supt. and Engr. Dept. of Water & Sewerage, Shreveport, La.; a member of the Association since 1918; Director representing the Southwest Section 1942-45; Fuller Award 1945. "A water works executive of high merit who has received the support of his fellow citizens over a long span of years."

Henry Berry, Past-Chairman Metropolitan Water Board, London, England; President British Water Works Association 1948-49; and Member of Parliament; a member of the Association since 1944. "An inspiring leader of an essential civilian activity in wartime; a useful servant of his people in time of peace."

M'Kean Maffitt, Former Supt. of Water & Sewerage, Wilmington, N. C. (now retired); a member of the Association since 1922; Fuller Award 1947. "Long devoted to the advancement of the water works industry and water works men in his state, using as a medium the North Carolina Section, of which he was an organizer, a driving force and membership builder."

The Diven Medal

The John M. Diven Memorial Medal, which goes to that member performing a noteworthy service to the Association, was voted to—

Harry A. Faber
Research Chemist, The Chlorine Institute
New York, N.Y.

"In recognition of his effective services to the Association, and for his contributions toward a better understanding of water chlorination and the safe handling of chlorine."

Awardees

Harry A. Faber
New York
(The Diven Medal)

Laurie M. Leedom
Newark, N.J.
(The Goodell Prize)

The Goodell Prize

The Goodell Prize is awarded annually to that member making a noteworthy contribution to the science or practice of water works

Vice President (Nominate)
W. Victor Weir
University City, Mo.

Treasurer (Incumbent)
W. W. Brush
New York

development. The Board voted this award to—

Laurie M. Leedom
Constr. Engr., Division of Water
Newark, N.J.

"For his paper 'Shutdown Procedure for Isolating Main Breaks' published in the April, 1948, *Journal of A.W.W.A.*," this paper being timely and highly valuable because of its constructively planned procedure for the restoration of water service after a main failure."

Limitations on Fuller Award Removed

After again reviewing the recently approved restrictions on the Geo. W. Fuller Awards by the Sections of A.W.W.A., and giving the matter thorough and thoughtful discussion, the Board's decision was that the restrictions limiting the number of living Fuller Awardees in any one Section, to a number proportionate to the number of members comprising the Section, be eliminated. The reasoning in this action was that even now some of the smaller sections would be prevented from making another Fuller Award until one of the awardees in the Section either died or moved to another Section. Further, the other Section would be penalized in its award quota. Since the restrictions would also prohibit the award being made to those officially representing Corporate Memberships, it was voted to also eliminate this restriction. The Fuller Award can now again be made to all

grades of members other than Affiliate or Associate Members.

Feeling that the Fuller Award procedure should be tightened up in other directions, the Board instructed Secretary Jordan to develop, with the cooperation of officers of the Fuller Award Society, a series of criteria as a guide to local Section committees in the selection of awardees. All that this means is that the Board does not believe that a ratio of numbers means anything, whereas the evident need for some tightening up of the procedure in evaluating the qualifications of prospective Fuller Awardees may be attained in a sounder manner, which is to say through restrictive specifications to be applied in the selection of awardees. Further, it was the opinion that a given Section in making too limited a number of awards may be as subject to criticism as a Section making too many awards.

Association Finances

Members of A.W.W.A. will be pleased to learn that the Association ended the year 1948 "in the black," thus confirming the good judgment of the Board in its decision to postpone increasing dues a year ago and decision to gamble on membership growth, sustained advertising in the *Journal*, and good management at the top, to hold the Budget in balance.

Members will also be pleased to hear that membership dues will not be raised in 1949 either, although due to increasing costs of producing the *Journal* (up 175 per cent since 1943) and the few new expenditures voted, the Association has the highest Budget in its history. With an anticipated increase in expenditures of about $35,000 over those of last year, the total (balanced) Budget is roughly $200,000 for the year 1949.

Since the income and profit from the *Journal* is of such importance to the Association, and makes possible the continuation of the *Journal* on its present high level and increased circulation in the face of non-increase in member dues, the Board authorized the Secretary to announce an increase in advertising rates in an amount not to exceed 20 per cent should costs of *Journal* production continue at current levels, or should costs increase further during 1949.

Pension Plan for A.W.W.A. Staff

A proposal to establish a "Retirement and Pension System" for the staff employees of the Association was first discussed by the Board in 1944. In the years intervening careful consideration of the terms of the procedure and the best plan to adopt has been given by a special committee of the Board. The plan adopted by the Board involves a contribution from the employees to the Retirement Fund, but the major expense of the Pension System will be borne by the Association. To the Board, the final adoption of a Retirement Plan for the Association's employees was an accomplishment long sought and now happily realized.

Public Relations Program and Water Works Compensation

The Board voted to continue the program of "Public Relations at Work," designed to keep members informed of case histories of actual procedures, developments and innovations in the public relations work of various water utilities, large and small. The distribution of such case histories is considered the simplest method of awakening the interest of hesitant water works managers not convinced of the value of a public relations program, not alone for the good of their Departments but also for a resultant betterment of appropriations and the salary scale for water works employees.

In the latter direction a part of the renewed $6,000 allocated for "Development Work" during 1949 by A.W.W.A. has been ear-marked for planning and initiating an investigation and study of compensation paid key water works employees. It is the present plan that such an investigation and analysis of water works compensation be conducted so as to show a comparison with compensation in other industries for positions of similar caliber, training required, and responsibility, as well as comparisons of compensation by water works of similar nature and size in various sections of the country. It is importantly the plan that the study will be made by some outside qualified organization, which will collect the information and develop the analysis of the water works compensation situation on a clear cut disinterested basis. Such an independent analysis of a disinterested fact-finding agency can then be used country-wide without supportable accusations of prejudice or selfish interest which would be directed at such findings if developed within the Association. Such a plan should likewise circumvent any cry of "unionism" from municipal authorities who may be inclined to "milk" the water works for the benefit of other municipal operations.

Recommendations of Policy Committee

The General Policy Committee (N. T. Veatch, Chairman) feels that the published objects of the Association as they now appear in the Constitution, having become out-dated, need revision and amplification. The Committee presented its recommended changes which were accepted by the Board for the required member vote by mail of acceptance or rejection. The proposed changes will first be presented for discussion at the 1949 Annual Convention in Chicago. Further, all members have received a copy of the proposed changes in the Secretary's report of January 31, 1949, to the membership. Two important amplifications are those which call for "the promotion of satisfactory relationships with the consuming public" and the "giving of proper consideration to and express opinions upon practices which will enable the industry to render the best service possible to the public".

After a study of a proposal to amend the Constitution so that proportional representation, or equivalent thereof, be provided within the Board of Directors so that each Section would have a voice in the affairs of the Association in proportion to the numerical membership of each Section, the Policy Committee recommended against any change in the Board from its present membership which is patterned after the U.S. Senate, wherein each state has equal voice in the Senate, regardless of size. The Board was of the opinion that no change in its present pattern appeared warranted or desirable. Fact is, the feeling was that the Board is even now of such a size as to make it somewhat unwieldy and its meetings rather expensive to the Association.

A recommended change in requirements for filing of application for Associate Membership and passing on such applications, as set forth in the By-Laws, was accepted by the Board. Also, henceforth any member becoming in arrears in dues shall receive copies of the *Journal* for 90 days only, and be dropped automatically from membership for nonpayment at the end of the year of arrears.

The Board approved the request of the Southwest Section that it be permitted to establish an annual membership gain award to whichever of the four States (Texas, Louisiana, Oklahoma, Arkansas) produced the greater number of new

members during the year when considering the number of potential members in the State against the number gained in that State during the year. The Board directed Secretary Jordan to remind other Sections that the policy of the Southwest Section in submitting proposed awards to the General Policy Committee for approval is in line with the expressed desires of the Board and the best interests of the Association.

The Board regretfully found it inexpedient at this time for A.W.W.A. to become a member of the proposed International Water Supply Association being developed by British and Dutch water supply authorities. The Board felt that under present economic conditions it was not feasible to finance the Association's sizable proportion of the expense of establishing and maintaining a productive membership and adequate participation in the International Association; and, further, that an association confined principally to the Western European countries would best serve those countries and have the greatest likelihood of success.

Water Works Practice

The Committee on Water Works Practice (L. R. Howson, Chairman) presented a full report covering its current and projected activities, and made a number of recommendations which received the Board's approval. Amongst the approved recommendations were the following—

1. Dissolution of present Committee on Well Pumps.
2. Dissolution of Committees on Distribution System Safety and on Cross Connections and establishment of a new Committee on Water Distribution Safety.
3. Advance of Specifications for "Cold Water Meters—Fire Service Type" to *Standard*.
4. That Committee A21 be requested to develop Standards for Mechanical Joints for Cast-Iron Pipe.
5. Participation by A.W.W.A. in standardization of "Rotary Cone Valves" and "Deep Well Pumps" under A.S.A. procedure. Proposal of A.W.W.A. sponsorship for Specifications for "Deep Well Pumps."
6. Expansion of the California Section Committee on "Coefficients of Flow in Steel Pipe Lines" to national scope.
7. Activation of a Committee on Asbestos Cement Pipe.
8. Approved in principle, the development of "Water Supply Standards" for adoption by A.W.W.A.

The Practice Committee also revealed the growing need for developing specifications, covering *prestressed* concrete pipes (cylinder and non-cylinder types), and that this task is now to be undertaken by sub-committee E7B under chairmanship of E. W. Whitlock.

The Committee on Fire Hydrants (Roger W. Esty, Chairman) on the first of the year filed its report recommending three major changes in the present A.W.W.A. specifications for fire hydrants. This report will now receive the attention of the Practice Committee for review before submission to the Board for action.

Honorary Members

Thos. L. Amiss
Shreveport, La.

M'Kean Maffitt
Wilmington, N.C.

It was brought to the attention of the Board that the recently developed "Recommended Procedure for Inspection, Repair and Painting of Elevated Steel Tanks" has been approved by the New England Water Works Association and the American Welding Society. To date no significant requirement of the document has been criticized by anyone, including tank repair and maintenance firms.

Water Works Administration

The report of the important recently created Committee on Water Works Administration (W. R. LaDue, Chairman) indicated that much has already been accomplished by the several sub-committees. The following list reveals those sub-committees already organized and active—

- Public and Consumer Relations
- Pension and Retirement Plans
- Compensation of Water Works Personnel
- Water Use in Air Cooling
- Radio Facilities for Water Utilities
- Municipal Water Works Organization
- Water Main Extension Policies
- Water Department Reports
- Joint Administration Water & Sewage Depts.

Epidemic of Polluted Water Articles

The Board took notice of the continued "epidemic" of publication of articles in popular magazines which tend to discredit or cast suspicion on the quality of water served American cities. While there is no foundation for any accusation that water purification in America has failed to safeguard water consumers against water borne diseases, it must be recognized that stream contamination by industrial wastes has been on the increase and demands corrective measures. The Board recognized the increasing responsibility of the water supply industry to maintain or improve its services and insure to the fullest extent possible that the best quality of water produceable be supplied to the consumers. In this direction the Board recognized an obligation to stress to public administrators and the public at large the current high importance of employment of only the most competent and experienced officials and workers in water departments if future epidemics are to be avoided and the highest quality of water produceable is to be served the community.

Relationships with Federal Agencies

Activities and policies of the Association as they relate to activities of Federal Agencies were reviewed. Cooperative relationships are being maintained with the U.S. Public Health Service, the Atomic Energy Commission, Office of Civilian Defense Planning, the Federal Works Administration, and the National Security Resources Board. In regards to the last named, a meeting between members of the N.S.R.B. staff having to do with public water supply planning in the direction of National Preparedness for any future eventuality and water works executives, consulting engineers and manufacturers of water works equipment and supplies was held in Washington on January 26.

The 1949 Convention

At the close of the Board meeting general arrangements and the technical program for the 1949 Convention in Chicago, May 30-June 3, were reviewed for the Board's benefit and discussed. From all indications the 1949 Convention is expected to establish a new all-time record in attendance. There will be innovations in the evening programs as well as the technical program, which is to feature the popular panel type discussions.

CORROSION CONTROL BY THE USE OF LIME*

A Review of the Basic Principles of the Process

by
EDWARD S. HOPKINS
Associate Engineer
BUREAU OF WATER SUPPLY
BALTIMORE, MD.

IT is common knowledge that soft water containing dissolved oxygen and free carbon dioxide corrodes iron and steel pipe excessively. In accordance with the electro-chemical theory, oxygen is the direct corroding agent with the *rate* governed by the reaction between the dissolved oxygen in the water and the film of atomic hydrogen at the surface of the metal[9]. It is also known that the hydrogen ion concentration of the water is not a factor in the initial deposit of rust on clean or bright iron surfaces, since the initial rate of deposition is about equal at pH values between 5.0 and 9.0. After the initial rust coating has been deposited, continued corrosion of the metal is in direct proportion to the porosity of this coating. Rust coatings deposited on pipe walls from waters containing "aggressive" carbon dioxide is porous while that laid down in alkaline waters is compact and dense[11]. Compact coatings of iron oxide or calcium carbonate, or a combination of both, will prevent diffusion of the dissolved oxygen in the water to the metal.

The Author

"Aggressive" carbon dioxide was the term employed by Tillmans[10] to describe the corrosive action of carbon dioxide dissolved in soft waters having low pH values. Massink and Heymann[8] demonstrated that the aggressiveness of the carbon dioxide is regulated by the total bicarbonate alkalinity and pH of the water. To measure the corrosivity of aggressive carbon dioxide bearing waters, von Heyer[5] developed the "marble test" now used as standard procedure.

Neutralization of aggressive carbon dioxide by alkali retards cold water corrosion by stoichiometric reaction and by the precipitation of the dense iron oxide-calcium carbonate coating on the pipe surface. It is, therefore, an indirect method of corrosion control. Lime or other alkali treatment will not *stop* corrosion unless the pH value is continually maintained at the calcium carbonate saturation point. The disappearance of "red water" is not necessarily a criterion of the elimination of corrosion, but does denote a reduction of corrosion.

The *rate* of corrosion in pipe lines is a function of the loss in dissolved oxygen from the water during passage through the system. A slight loss may be noted during corrective treatment, but an appreciable loss is noted when corrosion is occurring. Routine testing for dissolved oxygen is the best method for determining the extent and efficiency of any corrosion correction treatment.

Hot water corrosion, in relation to steam generation, is not eliminated by this treatment, since the bicarbonate ion is formed by the neutralization of the free carbon dioxide. Upon heating the water to boiling, the bicarbonate ion breaks down to free carbon dioxide and hydroxide, frequently producing corrosion in return condensate lines. Localized treatment at the steam generating plant is required to overcome this condition.

Treatment of Very Soft Waters

A soft water of less than 20 parts per million hardness, will have slight buffer action and maintenance of the calcium carbonate equilibrium through the addition of lime will require high pH values, resulting in caustic alkalinity. This is usually of minor importance to industry but may be objectionable to the taste in that it has a limy taste.

The Catskill water supply for New York City has a normal alkalinity of 8 parts per million. Hale[4] reports that neutralization of the free carbon dioxide in cold water with lime raised the pH value to between 9.7 and 9.9;

*Excerpts from a paper presented before the Technical Association of the Pulp and Paper Industry. Printed by permission of the Association.

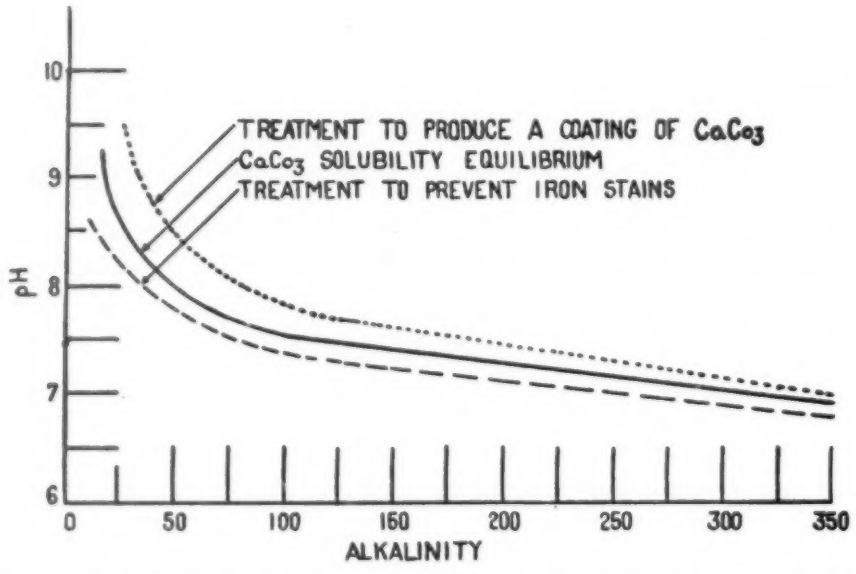


Fig. 1—Curves Revealing the Titratable Alkalinity and pH Values of Waters at the Calcium Carbonate Solubility Equilibrium Point, and the Sub-Saturation and Super-Saturation Points.

(In corrosion control the Carbonate Saturation Curve will shift downward for those waters which are naturally buffered. Note elsewhere in this article the pH and alkalinity found to apply in treatment of the Baltimore water—namely pH 7.8 at 38 ppm. of alkalinity.)

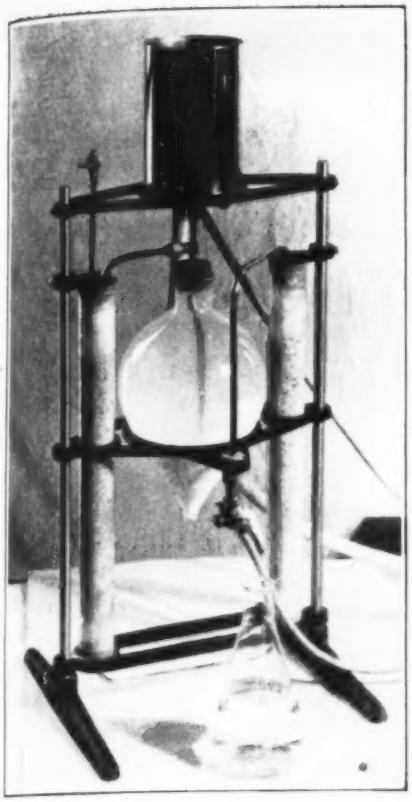


Fig. 2—The Enslow Continuous Corrosion and Stability Indicator.

(The well known "marble solubility test" adapted to continuous operation—the calcium carbonate saturation index being revealed by testing the water entering and leaving the Stability Indicator.)

with 10 parts per million excess calcium hydroxide the pH was 10.1; with 50 parts per million, 10.3-10.4 and with 100 parts per million it was 10.8. After 148 days, black iron pipe, ¾ inch in diameter, was heavily coated by a soft sludge of calcium carbonate. Flow decreased as follows:

Untreated water	— 55 percent
CO_2 just neutralized	— 35 percent
10 ppm. excess lime	— 20 percent
20 ppm. excess lime	— 15 percent
30 ppm. excess lime	— 10 percent
40 ppm. excess lime	— 6 percent
50 ppm. excess lime	— 8 percent
100 ppm. excess lime	— 16 percent

It may be concluded from the above data that high lime treatment is not practical for these soft waters without periodically flushing the system. With a gravity flow river water serving an industrial plant, this would not be expensive in comparison to the cost of pipe renewal. The introduction of substances to a very soft water to increase buffer action and lower the pH value necessary for corrosion control is not usually economically advantageous. Unless cheap water is available for flushing, replacement of corroded pipe is the most practical operation.

It is apparent, therefore, that lime treatment to eliminate corrosion has its greatest value with waters having a hardness greater than 25 parts per million.

Treatment Guides and Plant Control

Baylis[1] in 1922 initiated pH controlled corrective treatment with lime as a function of water purification, using the Gunpowder River supply at Baltimore, Md.

This water is moderately hard, having the following average analysis:

Alkalinity	— 35 parts per million
Soap hardness	— 38 parts per million
Bicarbonates	— 43 parts per million
Sulfates	— 7.9 parts per million
Free carbon dioxide	— 6 parts per million
pH	— 7.1 parts per million

To facilitate plant operation Baylis[2] studied the solubility of calcium carbonate under varying conditions of pH value and total alkalinity and prepared curves revealing the calcium carbonate saturation point under these various conditions. Fig. 1 reveals these values and serves as a practical guide. These curves show, for instance, that with a total alkalinity of 50 ppm. or less a pH of 8 or more is required to obtain calcium carbonate saturation.

Enslow[3] developed a continuous corrosion or stability indicator which keeps a constant flowing sample of water at the calcium carbonate saturation point. This device (Fig. 2), permits testing for the correct pH and alkalinity of the treated water as often as desired, and without laborious and time consuming operations. Usually a 4 hour contact period is given between the powdered calcium carbonate and the water passing through the unit. It is excellent for use with waters subject to changes in buffer characteristics. Any necessity for treatment change is easily detected by sampling of the water before and after passage through the Enslow stabilizer, which serves as a continuous "marble test."

The value of corrective treatment with lime or other alkali rests upon the *constant* maintenance of the hydrogen ion concentration at the calcium carbonate saturation point in order to maintain a thin but dense protective film. It cannot be an intermittent treatment, since at any time the water is below this value aggressive carbon dioxide is present and will redissolve the coating previously precipitated.

Accurate control of the lime dosage and precise pH values can best be had by the use of recording potentiometers. These devices (Fig. 3), are usually actuated by glass electrodes with ranges in pH from 2.0 to 12.0. The charts used on the potentiometer (Fig. 4), serve as a permanent record of the pH value of the delivered water and history of treatment. This equipment is inexpensive and trained technical skill is not required to keep it in good order.

Commercial dry feeders and other appliances are available for the application of lime to a water supply. Either burned pebble lime or hydrated lime may be used. Large plants find burned lime the most economical, when continuous automatic slakers are utilized.

Results of Treatment

Once calcium carbonate equilibrium has been established, the water will remain stable and the effect of lime treatment is apparent in pipe lines after a few months. The calcium carbonate solubility point for the Gunpowder River water supply of Baltimore is at pH 7.8 with an alkalinity of 38 parts per million. It will be noted from the table on the next page that the pH value of the water is constant after passage through 1200 miles of distribution mains and an open balancing reservoir of 459 million gallons capacity. Since passage through these reservoirs may be considered analogous to a spray pond, it is apparent that corrective treatment with lime has value for industrial use.

The value of protective treatment with lime is illustrated in a recent American Water Works Association committee report[7] which states:

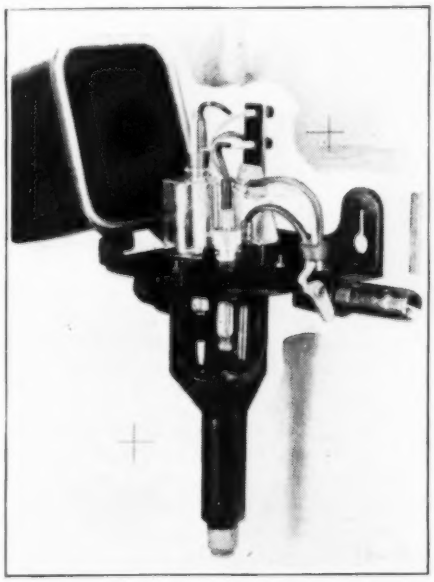


Fig. 3—The pH Recording Potentiometer.

(So useful in regulating and controlling lime application in anti-corrosion treatment of waters if the optimum alkalinity—pH ratio is to be maintained.)

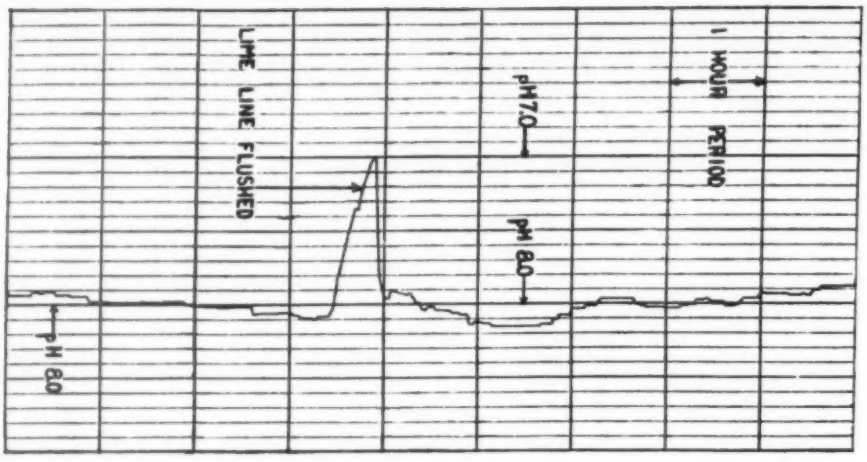


Fig. 4—A Specimen pH Chart Produced by the Recording Potentiometer.

(During this period the attempt was to hold the lime treated water to a pH of 7.9 to 8.0)

"Other factors being equal, the data show marked correlation between pH value of water carried, and rate of pipe line capacity loss. Average conditions reported indicate for supplies with a pH value of 6.5 twice the loss observed in supplies with a pH value of 8.0."

Other than causing a slight increase in hardness, corrective treatment with lime does not have a direct effect upon steam generation. Boiler water control is an independent function. However, warm water, 70° to 100° F, will be non-corrosive and treatment is a profitable undertaking.

Treatment Costs

By stoichiometric reaction, 1 part of carbon dioxide equals 1.275 parts of caustic lime and 1.903 parts of hydrated lime. Due to the buffer action of various waters, this direct relation does not exist when maintaining the calcium carbonate saturation point. For this reason it is not practical to compute the contemplated cost of treatment upon a direct ratio of carbon dioxide to lime.

The cost of corrective treatment of the Gunpowder River water has averaged 43.1 cents per million gallons over the past 25 years. This included labor, storage and depreciation. The 1947 cost was 35.9 cents per million.

Summary and Conclusions

The principles of the electro-chemical corrosion of iron and steel pipe by low alkalinity waters containing "aggressive" carbon dioxide have been reviewed.

The fixation of this carbon dioxide by the correct quantity of lime causes a dense, compact coating of calcium carbonate-ferric oxide to be deposited on the pipe walls. This coating, if of proper density prevents the diffusion of the dissolved oxygen in the water to the hydrogen film on the iron, thereby retarding corrosion. Rust deposited when the water is below the calcium carbonate saturation point will permit diffusion of the dissolved oxygen and does not check corrosion.

The treatment is not satisfactory for very low alkaline waters (10 ppm. or less) since overly high pH values are required, depositing a soft fluffy sludge-like coating in the pipe lines. This sludge is porous and sometimes of sufficient magnitude to retard flow.

pH OF SAMPLES FROM DISTRIBUTION SYSTEM
(15 Year Average)

	Plant Effluent*	Distrib. System 1st Zone**
January	7.8	7.6
February	7.8	7.6
March	7.8	7.7
April	7.8	7.7
May	7.8	7.7
June	7.7	7.7
July	7.7	7.7
August	7.8	7.7
September	8.1	8.0
October	8.5	8.2
November	8.2	8.1
December	7.7	7.6
Max. month	8.9	8.7
Min. month	7.0	7.0
Aver. month	7.9	7.8

*Samples collected every 2 hours.
**Samples collected weekly from 12 stations.

From what has been said, fairly accurate control of the lime application is necessary. For this purpose recording potentiometers serve a valuable purpose. Commercial dry feeders and slakers are desirable for the most economical and effective application of lime in corrosion control.

A water maintained just at the calcium carbonate saturation point has a stable hydrogen ion concentration and the pH value is usually unchanged in passing through a distribution system.

There is an extensive investment in iron and steel pipe which needs protection against internal corrosion.

Even though complete elimination of corrosion may not be attained by lime treatment, the value of the reduction, where the water is fairly corrosive, greatly exceeds the cost of treatment. Based upon public water supply experience, it is believed that corrective treatment with lime will produce a water of considerable economic value to many industries[6].

Literature Cited

1. Baylis, John R., *J. Amer. Water Wks. Assoc.*, 9; 408 (1922)
2. Baylis, John R., *J. Amer. Water Wks. Assoc.*, 15; 598 (1926)
3. Enslow, L. H., *Water Wks. & Sewerage*, 88; 107; 283 (1939)
4. Hale, Frank E., *J. Amer. Water Wks. Assoc.*, 26; 1315 (1934); 27; 1199 (1935)
5. Heyer, von; Tillmans and Heubelein "Die Unterschung und Bierteilung des Wassers und Abwassers." 4th ed., p. 40, Ohmuller, u., Spitta.
6. Hopkins, Edw. S., Armstrong, James W and Baylis, John R., *Ind. Eng. Chem.*, 26, 250 (1934)
7. Killam, Elson T., *J. Amer. Water Wks. Assoc.*, 28; 1293 (1936)
8. Massink, A., and Heymann, J., *J. Amer. Water Wks. Assoc.*, 8; 239 (1921)
9. Speller, Frank N., *Ind. Eng. Chem.*, 17; 235 (1925)
10. Tillmans, J., "Die Chemische Unterschung von Wasser and Abwasser," Wilhelm Knapp, Halle, 1915.
11. Whitman, G. W., Russel, R. P. and Altieri, V. J., *Ind. Eng. Chem.*, 16; 665 (1924)

Herbert H. Brown Dies

Herbert H. Brown, 54, superintendent of Milwaukee water works for the past eight years, died Friday, Jan. 7th, at Wisconsin General Hospital in Madison. Death came after an illness of four months.

Mr. Brown became Milwaukee's water works superintendent in 1941, after the retirement of the late Henry P. Bohmann.

He entered the city's service in 1922 and worked up through various grades in the City Engineer's Office. In the middle thirties, he assisted in designing and constructing Milwaukee's $40,000,000 filtration plant on the lake front.

Mr. Brown was a graduate of the University of Wisconsin and had served as captain of infantry in the 35th and 85th divisions in France in World War I. He was a member of the Am. Soc. of Civil Engrs., the Am. Water Works Ass'n., of which he was once a National Director, etc.

Surviving are his widow, a daughter and his mother.

INDUSTRIAL CONSUMPTION EFFECTS ON "ACCOUNTED-FOR WATER"

by

H. T. RUDGAL,

Supt. Water and Sewage Treatment Depts.
KENOSHA, WIS.

AT KENOSHA, Wis., the "Accounted-for Water," or ratio of water pumped into the distribution system to that measured by all customers' meters, was 85 per cent for the year 1947.

Ordinarily this result of 85 per cent of the water leaving the pumping station being recorded by the water department's meters would be considered very satisfactory. Why this apparently good result was instead the cause for some alarm serves as the basis of this article.

The Author

Accounted-For Water Drops

The facts are that the per cent accounted-for water for the years 1943, '44 and '45 averaged 94 per cent, with the maximum being 94.5 per cent in 1944. By the end of 1946, the accounted-for water percentage had dropped to 87 per cent, and decreased further to 85 per cent in 1947. Accounting for less water was a serious matter in that this also meant a proportionate decrease in water department income. Finding the cause and the answer to the reason for the progressive increase in unaccounted-for water became therefore a matter of first importance and concern.

Some of the things that in our case could be responsible for this decrease in accounted-for water are as follows:

The accuracy of the water plant's venturi meters might have changed. Our two 24-inch transmission mains, which pass under the Kenosha Harbor, might have developed bad leaks. The leakage from the 129 miles of distribution system piping and connecting services may have increased. The efficiency of some of the large water meters at industrial plants may have dropped off perceptibly, or a general lessening of the accuracy of all meters may have taken place. Some large user may have purposely, or inadvertently, made a new service connection ahead of the meter. Last, but not least, the records or method used to compute the per cent of accounted for water may have been in error.

Leakage Checked

First, any question as to the correctness of the venturi meter registrations was eliminated. High lift steam pumpage displacement tests checked within 7/10 of one per cent with the results obtained by venturi meter measurements. An additional check on high lift pumpage was possible by comparison with the low lift pumpage measurements.

Each of the two 24-inch diameter transmission main harbor crossings was checked for leakage, by 10 hour

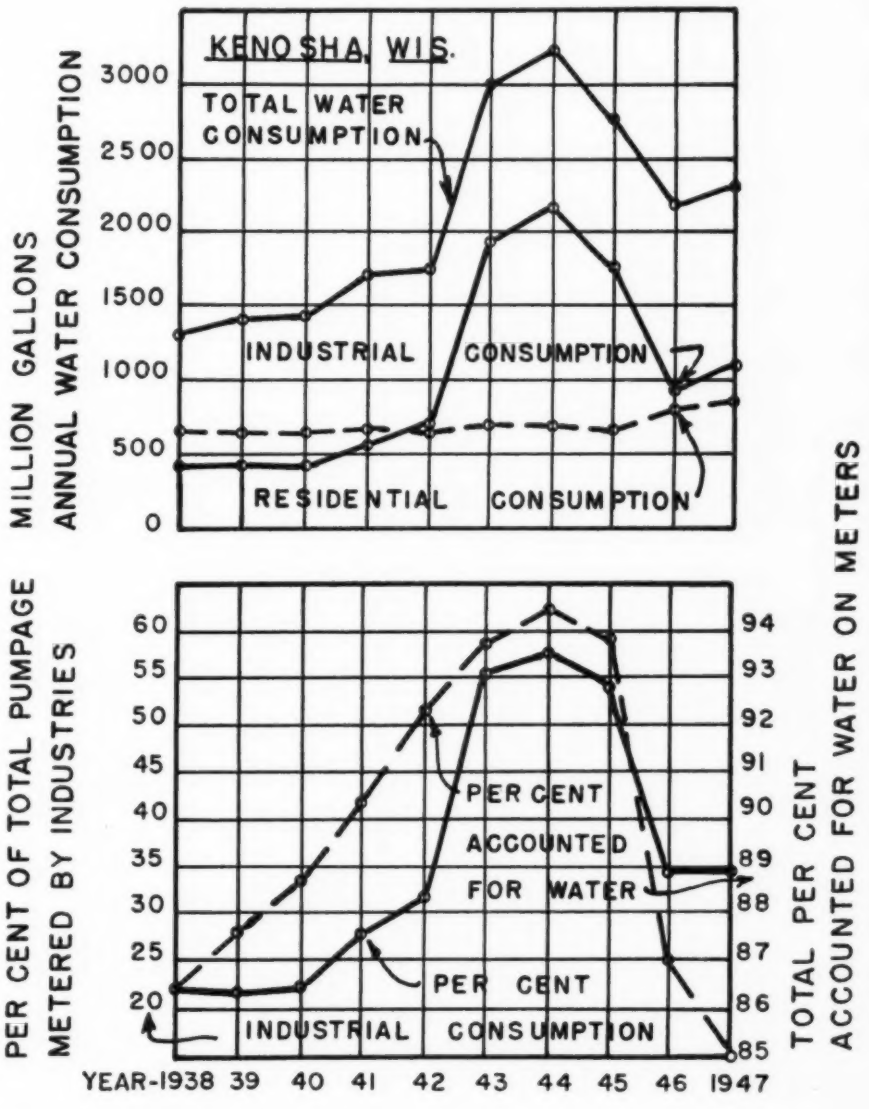


Fig. 1.—Relationship Between Total Accounted-for Water and the Percentage of Water Used and Measured by Industrial Group of Meters—Kenosha, Wis.

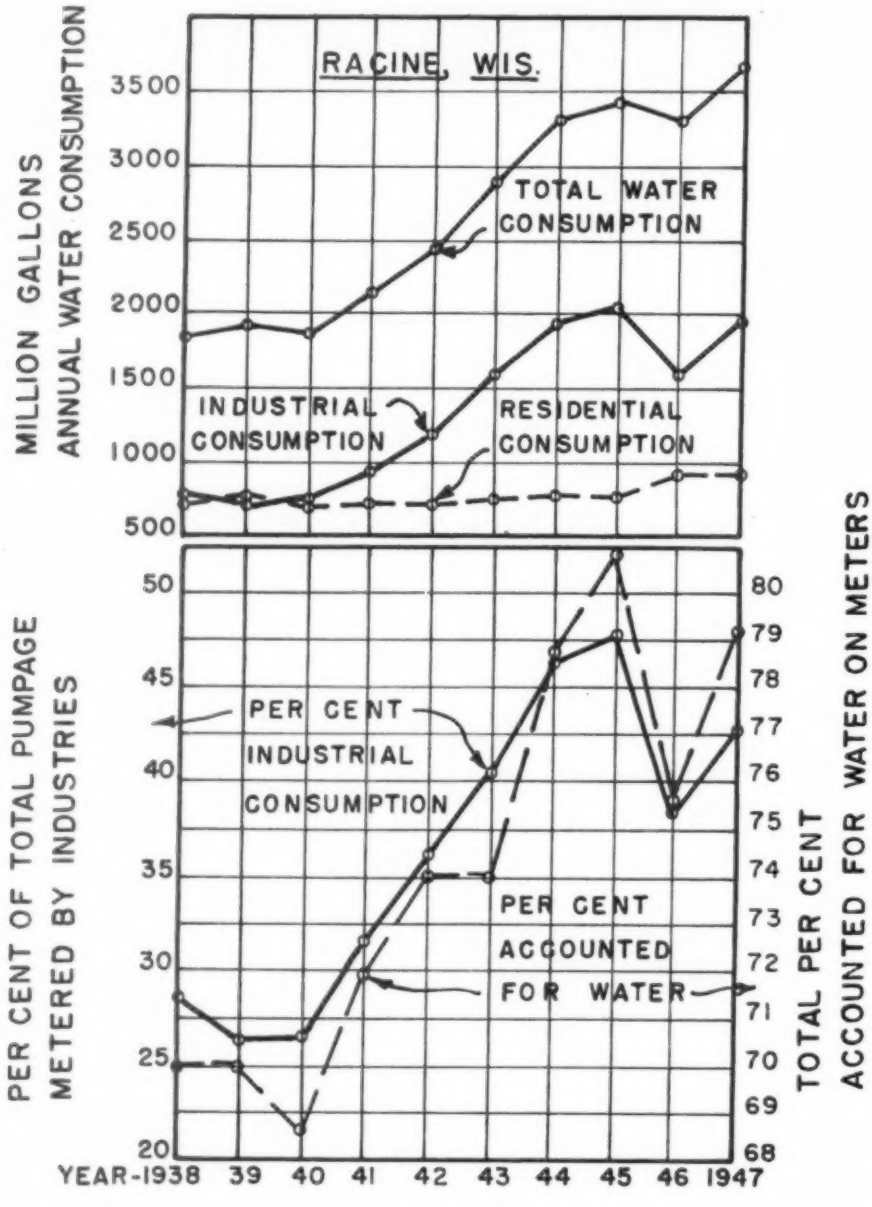


Fig. 2.—Relationship Between Total Per Cent Accounted-for Water and the Total Pumpage as Measured by Industrial Meters—Racine, Wis.

tests, early in 1947 and 1948. The method of checking these mains consisted of measurement, by a disc meter, of the flow of water through a by-pass line around one of the gate valves used to isolate these sections of piping. These tests could not be rated as entirely conclusive for the reason that the reliability of the results obtained was dependent on having perfect closures of the gate valves at each end of the section of piping being tested. In any case, however, the tests did show that under the same test conditions, the leakage had not increased in the one year period between tests. The maximum leakage was determined as being 5,800 gallons per day for the 465 feet length crossing, and only 3,000 gallons per day in the 520 feet section. From the results of these tests it was assumed that the harbor crossings were not the cause for the increase in lost water during the past two years.

An increase in underground leakage from the distribution system was of course a definite possibility. As a pitometer survey was not felt to be warranted at this particular time, leakage surveys were made, however, by patrolling the major portion of the distribution system during periods when frost or light snows covered the ground, in the search for wet spots over the water mains. Several small leaks were found and repaired, but none of these could be credited with the large increase in water unaccounted for.

Check of Large Meters

The next possibility for quickly locating some of the lost water was a check on the accuracy of large water meters installed at industrial plants. In 1947 about 47 per cent of the total water consumption was accounted for on 32 accounts involving 115 meters, ranging in size from 1 to 10 inches. It is obvious that if only a few of these meters were inaccurate or under registering, the total accounted-for water would be affected. Of the 115 industrial service meters, 70 meters are 2 in. in size or less, while the other 45 larger meters include 28 6-in. meters, most of which are installed on private fire lines. Practically all of the 2-in. and smaller meters, due to the ease of their removal, received regular periodical meter shop tests. This along with monthly checks on their operation and comparison of monthly consumption rates justly permitted us to reason that under registration of water should not be attributed to this group of meters.

As to the 3-in. and larger meters, these had been tested by the Pitometer Co., Inc., in 1938, but not checked again as to accuracy until 1948. Several fire line meters indicated regular use of water for other uses than fires and as meters on these lines are not very accurate for measurement of smaller flows, some loss of registration might be credited to same.

It was hoped that field tests as to the accuracy of 12 large compound meters, which also had not been retested since 1938, would supply the answer as to why 9.5 per cent less water has been accounted for since 1944. To our chagrin, however, only one of these meters was found to be under registering by 5 per cent, while 5 meters were found to be over registering from 1 to 5 per cent above the allowable limit. One other meter was found to be in poor condition, showing a maximum rate of over registration of 15 per cent. This meter was of course removed for shop testing and repaired. So here again, we failed to find the answer to our problem of why the less accounted-for water.

As to the residential and commercial account meters which by the end of 1947 totaled 11,185 meters, these receive periodical meter shop tests. In fact the tempo of meter testing had been increased in 1946 and 1947, whereby 14 per cent of these meters were checked annually or at the rate of once each 7.1 years. During 1944 and 1945, the rate of testing was 12 per cent annually, or at the rate of once each 8.3 years. Knowing these

facts, it was felt that it was proper to conclude that a general drop in efficiency of the large number of smaller meters had not taken place.

As to some illegal water connection having been made, there is always such a possibility but, for the time being, no special investigation was made since it was considered a very remote probability.

Determination of Accounted-for Water

The determination of the per cent of accounted-for water in our case involves plant records as to pumpage into the distribution system, exclusive of water used at the plant, as related to office records of water metered by all customers' meters. This appears to be a simple matter and would not be too involved if *all* meters were read and accounts billed monthly, or even quarterly.

At Kenosha, the situation in regard to determining accounted-for water is somewhat more involved, the reason for this being that the city is divided into 3 meter districts wherein, at two month intervals, all meters in only one of the three districts are read and billed. This means that each of the residential meters is read twice during the year, but with only about one-third of the total number of meters being read for each billing period. Industrial meters and some special accounts, however, are read monthly, but these also are billed on a semi-annual basis.

This meter reading and billing setup provides the means for determining only the industrial consumption accurately on a calendar year or shorter period basis. Water consumption as determined by the readings of all other meters, which includes the residential, commercial and public accounts, represents 12 months' water usage by each meter, but not the water used during the calendar year. For example, District No. 3, billed in February, includes 5 months' water used in the previous year and 1 month of the current year. District No. 1, billed in April, includes 3 months of water usage in that district during the previous year, while District No. 2 billed in June, still includes water metered during the previous December.

Up to the present time the practice in determining the quantity of water metered by all customers' meters during a calendar year, has been to compute the industrial consumption by using the December meter readings and to assume that the total for six consecutive billing periods, starting with the April billing, represented water consumption for the calendar year by all other than the industrial accounts. At best, this computation method while giving a fairly accurate answer is still somewhat approximate, for the reason that the water consumption measured by other than industrial meters is not entirely that used during the calendar year, and yet is compared with a calendar year's pumpage.

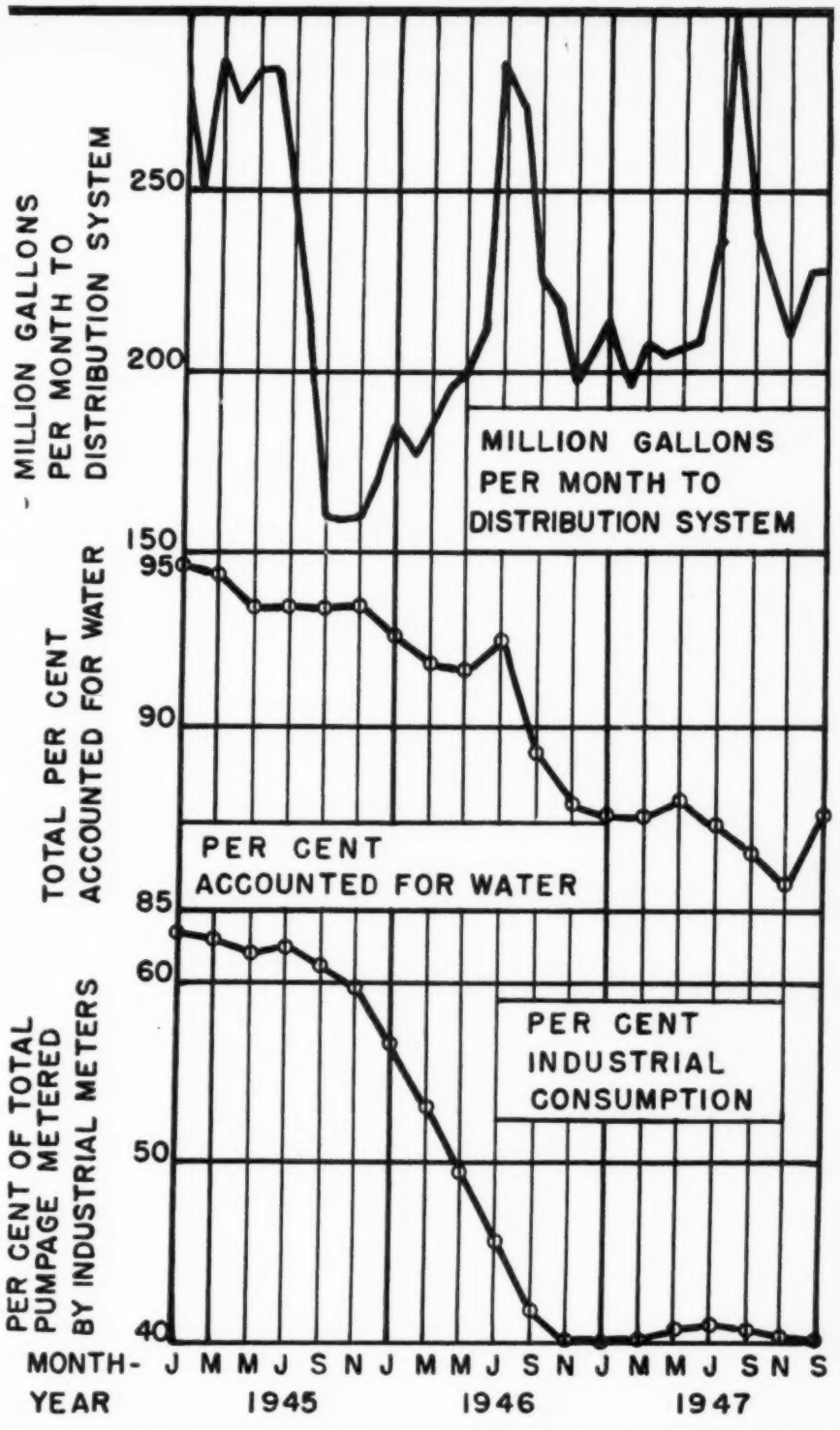


Fig. 3—Three year Relation Between Industrial Usage and the Per Cent Accounted-for Water.—Kenosha, Wis.

An independent check was made of all data pertaining to and required in checking and computing the per cent of accounted-for water for a number of years, and no errors were found.

We now had, in one manner or another, eliminated a number of possibilities as to the cause for the decrease in efficiency of accounting for water and had still failed to find an answer, unless undiscovered underground leakage was given the blame.

Effect of Industrial Consumption

Further studies relative to this problem finally produced data which made it evident that a relationship did exist between total accounted-for water and the percentage of water used and measured by the industrial group of meters. This Kenosha data is presented in graphical form in Fig. 1.

An analysis of these data shows that during the 4-year period starting with 1943, the total per cent of accounted-for water is almost directly proportional to the per cent of total pumpage metered by the industrial group of meters. Prior to 1943, however, this relationship is not proportionate in the same degree. A logical explanation for this is that during 1939, 1940 and 1941, a total number of 1,997 of the ⅝-in. meters were condemned and replaced with new meters. Replacement of approximately 20 per cent of the small size meters, then in service, was done for the purpose of obtaining better metering efficiency, and the data shows that the percentage of accounted-for water did increase during a period when industrial consumption remained somewhat constant.

As to the reason for the further drop from 87 to 85 per cent in accounted-for water from 1946 to 1947, during a period when there was little change in water consumption, must be attributed to some other cause, which as yet has not been determined.

Fig. 1 also shows that in the 10 year period from 1938 to 1947, annual residential water consumption remained practically uniform, while the annual industrial usage of water, due to war production activities, varied considerably. These data, when compared to accounted-for water, serves to further prove the conclusion that industrial water consumption as measured by a relatively few meters does affect metering efficiency and in turn the total per cent accounted-for water.

Having found a logical answer as to the reason for a major portion of the pronounced decrease in accounted-for water, it was decided to check if this condition also applied to other cities of about the same population as Kenosha.

Data for such a check were obtained from the Racine and Sheboygan Water Departments, but only the Racine data are presented in graphical form.

Fig. 2 presents Racine, Wis., data as to annual water consumption and the relationship of total per cent of accounted-for water to the per cent of total pumpage as measured by the industrial meters.

A study of this exhibit shows that the similarity and relationship of the two curves, per cent accounted-for water and per cent industrial metered, is even more pronounced than is true of the Kenosha data.

Fig. 2 also shows that Racine's annual residential water consumption was fairly uniform throughout the 10 year period. A comparison with data in Exhibit "A" shows that the residential consumption curves are almost identical. At Racine, industrial water usage was also responsible for the yearly variance in the total annual water consumption. Since it is evident that the per cent of accounted-for water varied proportionately as the per cent of the annual industrial consumption, this serves as further proof that the percentage of water measured by industrial meters is a very important factor in accounted-for water results.

An analysis of data received from Sheboygan, Wis., where there was a less marked increase in industrial consumption during the war years, showed that the per cent of industrial consumption of total water pumped was 35.5 per cent in 1938, and increased to 47.6 per cent in 1943. During this period, the per cent of accounted-for water increased from 71 per cent in 1938 to 81.4 per cent in 1943. As to residential consumption during this period, a decrease occurred between 1938 and 1939, but otherwise consumption as registered by these meters remained reasonably uniform.

From this study relative to accounted-for water, it is apparent that one of the factors which must be considered in comparing per cent accounted-for water results is the per cent of water metered by a small number of larger meters such as the industrial meter group.

In that the per cent accounted-for water varied proportionately to per cent metered by industrial meters, shows that this group of meters in three Wisconsin Cities measured water more efficiently than was true in the case of the remainder of the meters in the water system. From this fact it is also evident that it is dependent on which group of meters performs more efficiently, as to whether the per cent of accounted-for water will increase or decrease, as per cent industrial consumption rises.

Due to the fact that at Kenosha all, other than industrial meters, are read at 6-month intervals, but only the meters in one of three districts are read at one time, it means that it is not possible to obtain an accurate figure, which one can definitely say is the total water metered for the same 12 month period by all meters in all meter districts.

For this reason, in 1948, a computation method was devised wherein a correction factor, based on the variance in monthly pumpage rates, is applied to certain billing period records. By this method, it is possible to obtain a total water consumption figure which, theoretically at least, represents water measured by all meters, during the same period of time.

The per cent of accounted-for water for 12-month periods at two-month intervals was computed and likewise the per cent of industrial usage was determined for a three-year period, starting with January, 1945. This data is shown in Fig. 3.

This exhibit graphically shows the monthly variation in gallons pumped per month and per cent of accounted-for water and industrial consumption for 12 month periods, at two month intervals. Here again the relationship of the two percentage curves is evident, and it is possible to check when the drop in the per cent of accounted-for water started to take place.

In conclusion, similar decreases in accounted-for water may have been experienced elsewhere, with the reason for the drop in metering efficiency not being apparent. The data presented may serve as a clue to the cause and definitely prove that the per cent industrial consumption can affect "Accounted-for Water."

L. G. Mort Accepts Conn. State Appt.

Argraves & Mort, consulting engineers of New Haven, Conn. and New York City, have granted Linwood G. Mort, a partner in the firm, a leave of absence to assume the post, on a temporary basis, of Director of the Real Assets Division of the State of Connecticut. The appointment of Mr. Mort to this position was made by the State Comptroller.

The Real Assets Division of the Comptroller's Office of the State of Connecticut has charge of design, supervision of construction, and maintenance of all state buildings and institutions.

Mr. Mort is a registered professional engineer, a member of A.S.C.E., A.W.W.A., and A.S.T.M., as well as local civil engineering organizations.

24-INCH CAST IRON RIVER CROSSING INSTALLED IN KANKAKEE, ILL.

by
DEWEY JOHNSON
Asst. Engineer
CAST IRON PIPE RESEARCH ASSN.
CHICAGO, ILL.

THE Kankakee Water Co. installed a 24-inch flexible joint cast iron transmission main across the Kankakee River in the summer of 1948. The river is 640 feet wide at the point of crossing between the banks and has a depth of 18 feet in the middle. The entire channel is solid rock with about a foot of soft, fluffy deposit over the rock. The river crossing, installed by the flotation method, was completed with such ease and speed of construction that a detailed description of the work is warranted.

The Author

The pipe selected for the work was furnished by the American Cast Iron Pipe Co. and is known by the trade name of "Molox." It is of Ball and Socket flexible joint type and will deflect 15° in each joint. The banks of this river were of gradual slope and only a 5° deflection was necessary. A trench was first cut in the north bank and required the services of a drag line for one day. Then two days were required at the south bank for the approach trench due to the necessity of blasting an area of rock that could not be reached with a drag line.

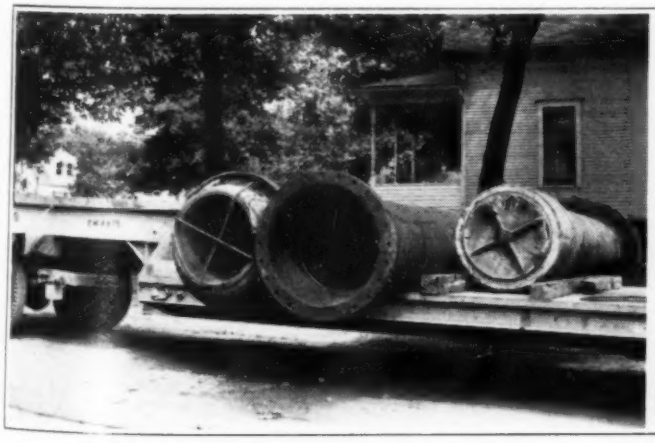
After the approach trenches were completed, a 10-inch I-beam 20 feet long, was laid flatwise and supported by railroad ties at an angle of 5° for the pipes to slide down into the river. One length of the Ball and Socket was cut in two at the middle and a sleeve with a plug in it was calked on to the end to serve as a front end of the pipe line to be floated and pulled across the river. The other half was saved for making the final tie-in. This 8-ft. piece and two 16-ft. lengths of pipe were then bolted together and slid down the I-beam. At their junction with the water line, three empty oil barrels were attached to each length of pipe. Then the next two lengths of pipe were attached and the pipe was slid into the river.

At this point in the launching operation, it was found that three oil barrels did not provide sufficient buoyancy to keep the front end of the pipe line off the river bottom, as there was enough friction in the Ball and Socket pipe to require extra barrels for buoyancy to keep the pipe from catching on the rocks projecting from the bottom of the river. A day was spent in adding extra oil barrels to the first two lengths and overcoming other minor kinks in the launching operation.

After these changes were taken care of, the launching operation then proceeded steadily with an average of one pipe being launched every half-hour of working time. This included the cleaning of the Ball and Socket joint, the bolting up of the joint, the attaching of three oil barrels to the pipe by means of wire, and the pulling of the bolted section into the river. A ½-inch steel wire cable was used for pulling the pipe across the river and was attached to a caterpillar tractor on the other side.

A second wire cable, ¾-inch in diameter and 700 feet long, was wired to the pipe as it slid into the river; then the three barrels were wired to the ¾-inch cable with loops provided in the attaching wires. The ¾-inch cable served as a connecting medium between the pipes and the barrels and was used as a submerging device. When the line was completely assembled and floated into place across the river above its exact permanent location, this ¾-inch cable was attached to a large tractor and pulled through the loops holding the barrels to the cable. This method of launching worked very satisfactorily.

The submerging part of the operation took only a short time. Each of the Ball and Socket pipes weighed over 4,000 pounds, but due to the fact that the pipe line was kept full of air, it was only necessary to provide three empty oil drums to take care of the difference in weight, except at the



Delivery of First Three Pieces of 24-in. Molox Pipe
(Note that the first piece is sleeved and plugged. Ball joint covered for protection.)

Sliding Second Section Down 10-in. I-Beam
(Beginning of 640-ft. river crossing laid in 18 ft. of water.)

Cleaning the Ball Joint for Bolting

Bolting Ball and Socket Joint

front end. This weight is about twice that of the ordinary 24-inch Cast Iron Pipe which is used for city distribution work.

One of the unforeseen difficulties that could be better classified as an aggravating nuisance, was the waves set up by the high school boys out in their high-speed motorboats adjacent to the pipe line installation. It was necessary to keep lights and flags on the line as it progressed across the river at all times, in order to keep these motorboat enthusiasts from running into the line. The pipe was suspended by the barrels at a depth of 13 inches below the water surface. The motorboat operators could see the barrels but could not see the pipe. Considerable time and energy was spent in keeping the lights and flags attached to the oil drums as the line progressed across the river.

The job was installed by ordinary workmen accustomed to doing cast iron distribution work, without the aid of a professional diver, as all of the joints were bolted together above the water on the south bank of the river as the line progressed. Ni-Resist cast iron bolts were used for all the joints and none of these were broken during installation. A total of ten working days was required for completion of the work, after which a suitable pressure test was applied to the crossing and a small meter attached to measure any leakage that might occur. This showed the crossing to be tight and better than required by the American Water Works Association specifications for tightness.

The river crossing was a part of the new feeder main extending from the filter plant to the southwestern section of the city. This feeder main required 6,700 ft. of large diameter pipe. A rapid increase in the industrial demand has required a general expansion program of the entire system. Four new filters of 1,000,000 gal. capacity each are being added to the treatment plant along with the other necessary appurtenances for treating an additional three to four million gal. per day. All of the water is softened and filtered as the river water is quite hard. The Kankakee Water Co. has over 8,000 service connections and supplies from 6.0 to 6.5 mil. gal. of clean, pure and softened water per day to 30,000 persons.

All of the work was performed by the Triangle Construction Co. of Kankakee. The water system is owned by the Kankakee Water Co., of which Mr. Lynn O. Minor is Treasurer and Manager.

Barrels Attached for Floating Pipe While It Was Being Pulled Across the River

Final Section of River Crossing Before the Final Closure Was Made

W. R. Seeger Becomes Asst. Gen. Mgr. San Rafael, Calif.

Announcement has been made that the Board of Directors of the Marin Municipal Water District of San Rafael, Marin County, Calif., has appointed William R. Seeger as assistant general manager. Mr. Seeger has been serving the District as assistant chief engineer.

Construction Forecast for '49

The Federal Works Agency has forecast the anticipated construction for 1949 to include a total of 525 millions of dollars in sewage and water works construction, and 800 million dollars in conservation and development.

The estimated expenditure in 1948 was approximately 460 million dollars for sewer and water works and 610 million for conservation and development.

RESERVOIR CONSTRUCTION COSTS LOWERED BY UNDERDRAINING SUBSOIL

THE Detroit Department of Water Supply, which now serves approximately 2,400,000 people, is being enlarged to provide an adequate water supply for an estimated 3,000,000 persons in 1970. Analysis of the demands on the works over the past 32 years led to the conclusion that the following values may safely be used for future design and expansion of the system as a whole.

Gallons per capita per day	140
Ratio of maximum to average day	1.55
Ratio of maximum to average hour	2.70

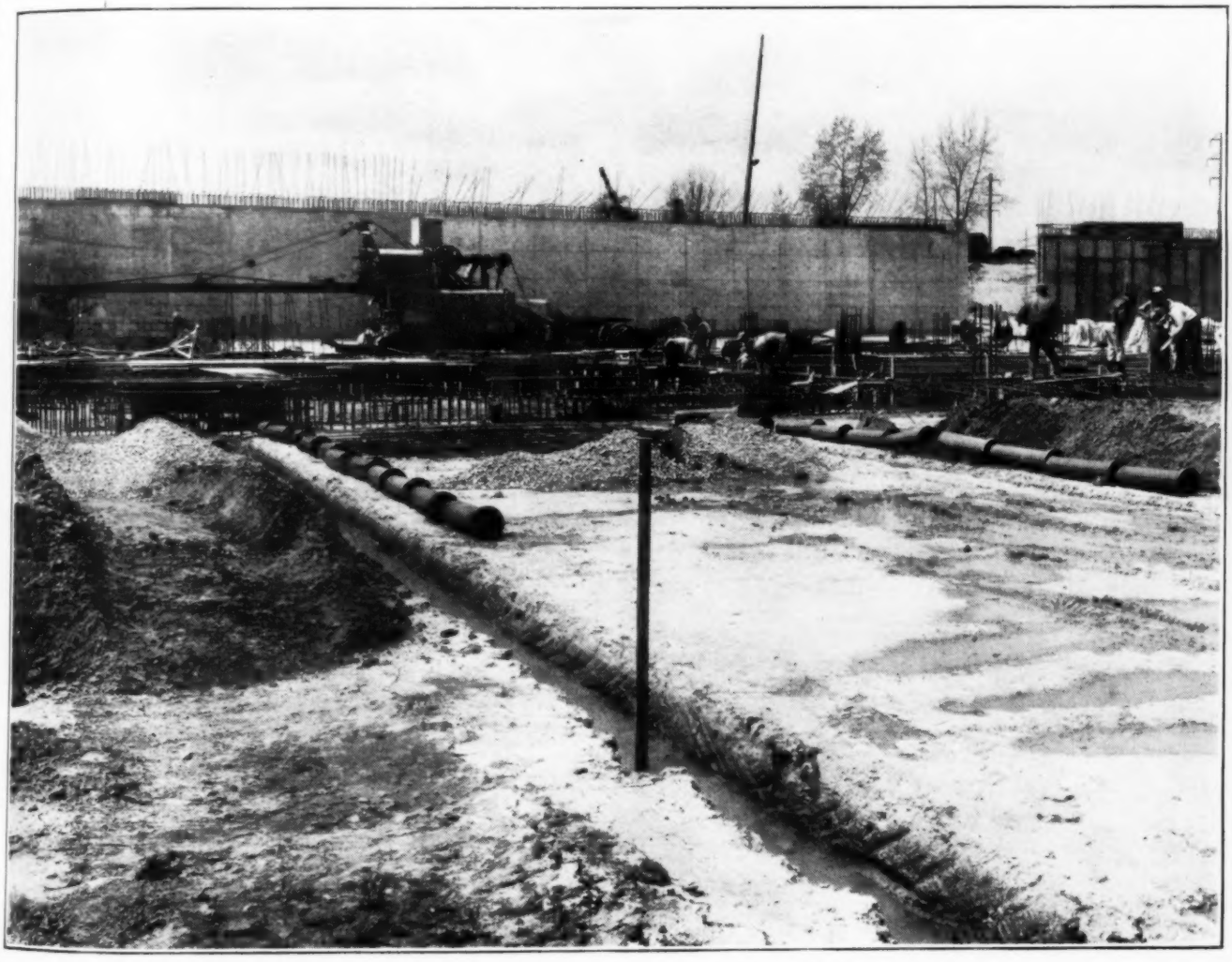
Figures from this table show that the entire system must be in a position to meet a maximum hourly rate of 1,134 million gallons per day and a maximum day demand of 650 million gallons by 1970.

Existing facilities can deliver water to the system at the hourly rate of 880 million gallons per day, at a minimum pressure of 30 psi at city limits. The two present stations, Water Works Park and Springwells Station, still have 274 million gallons per day to be made up by the new station.

Construction is underway on a new 30,000,000 gallon reservoir structure, and on a temporary booster station, on a 62-acre site at Eight-Mile Road and Grand Trunk Railroad. A new purification plant, to treat Detroit River water, will be equipped with flocculators, coagulation and sedimentation basins, rapid sand filters, high and low lift pumps, chlorinators, and a complete power plant. Water will reach the station through a 10-foot diameter tunnel five and one half miles in length, and at an average depth of 85 feet. The new reservoir will be filled either from the Water Works Park or Springwells Station, or both, during off-peak hours for storage and repumping into the distribution system during periods of maximum demand. The temporary works, when completed, will serve in the interim as a peak-load station.

Soil Investigations

Fourteen bearing tests were made on the site before the design for the reservoir was started, samples being taken at each five-foot depth. The Soils Mechanics Laboratory of the



Detroit's New 30,000,000 Gal. Ground Storage Reservoir Under Construction.

Underdrain system, being laid just ahead of reinforced concrete floor, makes possible less expensive construction through earth foundation stabilization.

Department of Engineering Research of the University of Michigan performed all soil tests. The data derived from the tests were used in determining the safe bearing capacity of the soil embankment slopes required to insure stability during construction, and also of the boundaries of the area adjacent to the construction upon which superimposed loading would have to be limited to protect the excavation against upheavals and slides.

With the reservoir full, the average pressure on the soil will be 1,740 pounds per square foot. The highest intensity of 2,250 pounds per square foot will occur under the wall footings. Average pressure when the reservoir is empty will be 650 pounds per square foot. Investigation shows that these conditions of loading are well within the safe bearing capacity of the soil, and that the reservoir when empty will be safe against uplift from soil or ground water pressure.

Reservoir Structure Design

Three types of construction for the reservoir masonry were considered in preliminary design studies—rigid frame, "slab band," and the flat slab. The use of piling foundations was considered primarily for anchorage against flotation, and for footings in the rigid frame. In view of the excellent bearing capacity of the soil, however, it was decided to omit piles and employ two-way flat slab construction for the roof and base slabs, with the vertical walls designed as fixed end slabs.

Underdrainage

The reservoir structure will rest entirely upon the soil surface without the aid of piles. Sub-drains are provided to stabilize the soil foundation and also to keep ground water out of the reservoir. Cost of the underdrainage system is estimated at approximately $23,400, based upon the following:

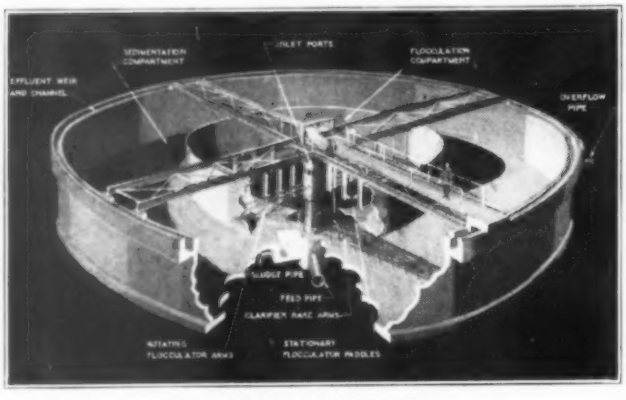
6"	Perforated extra-strength clay pipe in place, including excavation and backfilling	15,000 ft.	$15,000
12"	Perforated extra-strength clay pipe in place, including excavation and backfilling	2,600 ft.	3,900
	Porous material	1,500 cu. yds.	4,500
		Total	$23,400

All plans for the underdrainage system have been approved by the Michigan Department of Health.

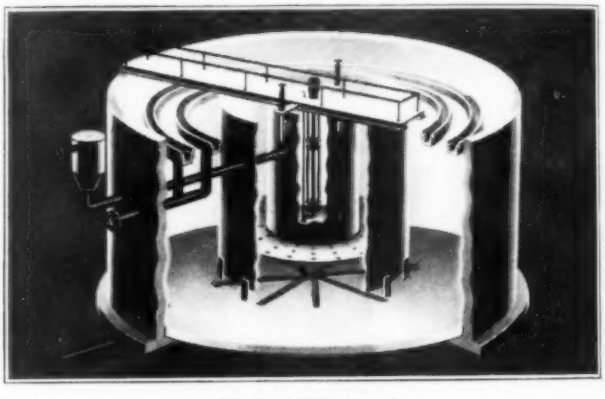
Two hundred and six pressure relief valves installed in the base slab will protect the structure against flotation when empty. These valves are designed to open when the differential head of water, ground water level to reservoir level, is four feet less than that required to float the structure. This arrangement will also serve during the construction period, before the drainage system is in operation. It is unlikely that these relief valves will ever be called upon to function, but will constitute justifiable insurance at the relatively low cost of $10,000 installed.

OUR MISTAKE

Switch of Equipment Trade Names Unintentional



Dorr "Clariflocculator"



Walker "Clariflow"

Our attention has been called to the fact that in the Annual Review of Water Supply Developments in 1948 appearing in the January issue there was an incorrect labeling of one of the pieces of equipment shown.

To be specific, on page five there appears a piece of equipment labeled "Walker Process Equipment Clariflocculator". This equipment is known as the "Walker Process Equipment Clariflow." The "Clariflocculator" is a piece of equipment manufactured and marketed by the Dorr Co. Both names are registered trademarks and the switch, while unintentional, is regretted. The error was not made by the author of the review.

In order that there be no confusion of these terms, herewith is shown a picture of the Dorr Co. "Clariflocculator," and the Walker Process Equipment Co. "Clariflow."

It has also been called to our attention that on page five of the January issue, in discussing the Dorr Co. system for calcining lime sludge, the spelling is not correct according to the registered trademark. This system is known as the Dorr "FluoSolids System."

We regret these errors in not sufficiently distinguishing registered trademarks.

PAY-OFF IN RESEARCH

The Engineering College Research Council of the American Society for Engineering Education has issued a booklet called "The Pay-Off in Research."

This booklet contains twelve articles on an extensive number of engineering research problems. These problems range all the way from those classed as fundamental to those approaching the level of gadgeteering.

Copies of the brochure are available from John P. Weber, Assistant Secretary, Iowa City, Ia.

TWENTY-FIRST N.Y.S.S.W.A. MEETING SETS ATTENDANCE RECORD

Holds Joint Session with San. Engr. Div. of A.S.C.E. and New York Section of A.W.W.A.

A Report by
HARRY A. FABER*
Editorial Associate
WATER & SEWAGE WORKS

Presidents

Incoming	Outgoing
Paul E. Bardet	*E. C. McKeeman*
Sr. Sta. Engr.	*Supt.*
New York City	*Freeport, L. I.*

THE twenty-first annual meeting of the New York State Sewage Works Association, held in New York City on January 21st, presented a co-ordinated program in conjunction with the Sanitary Engineering Division of the ASCE and the New York State Section of the AWWA. The registration of more than 500 at this joint meeting set an attendance record for this sewage works association.

Arrangements for the meeting were made by a committee whose members included George E. Symons for the NYSSWA, J. McClure Wardle for the New York Section AWWA, and Harry Freeburn for the Sanitary Engineering Division ASCE. The technical program, developed by a committee headed by C. J. Velz, was of interest to members of all three associations. Following the technical program, the Water and Sewage Works Manufacturers Association welcomed registrants at a Social Hour. On the day after the meeting an inspection trip was made to the 26th Ward Sewage Treatment Works, Brooklyn, N. Y.

Guest speaker at the luncheon was Hon. Harold C. Ostertag, Chairman, Joint Legislative Committee on Interstate Cooperation, State of New York. His topic was "POLLUTION CONTROL LEGISLATION IN NEW YORK STATE." Assemblyman Ostertag predicted that the current session of the State Legislature will enact an effective water pollution control act to correct pollution of the state's streams.

Pollution Control Planned

While 330 communities and many industries of the State do treat their wastes, the resulting benefits are nullified by the failure of others to do so. At present, more than a billion gallons of raw sewage and untreated industrial wastes flow into New York State's watercourses every day. A special committee on pollution abatement, functioning within the Interstate Committee, was authorized two years ago to formulate the program embodied in the water pollution control act. The Board to be created under this act will have authority to prohibit new discharges of waste and to require the progressive abatement of existing pollution.

Awards

R. S. Rankin	*W. N. Torpey*
Mgr., San. Sales	*Civ. Engr.*
Dorr Co.	*Dept. Pub. Wks.*
New York City	*New York City*
(Kenneth Allen)	*(L. V. Carpenter)*

The functions of the pollution control board, within the State Department of Health, will include: classification of waters according to their best uses, setting up standards, and requiring the maintenance of the standards on a systematic time schedule. In the program, due allowance will be made for the fiscal and technical problems which must be solved by municipalities and by industries.

"FEDERATION AFFAIRS" were ably discussed by Secretary W. H. Wisely, who expressed regret that V. M. Ehlers, Federation President, was prevented by illness from attending. Mr. Wisely spoke with deserved pride of the continued growth of membership and discussed certain problems, particularly the greatly increased cost of printing *Sewage Works Journal*. When the *Journal* is published monthly, beginning January, 1950, much needed space will be made available for a larger number of technical papers. L. H. ENSLOW, A.W.W.A. President, reported briefly on the meeting of the Board of Directors of that Association, noting that membership has now passed seven thousand.

Awards Presented

Edwin C. McKeeman, retiring President of the NYSSWA, was presented by incoming President Paul E. Bardet with the certificate and medal with which this association recognizes each retiring president. Chairman of the Memorial Awards Committee, George E. Symons, made the following awards:

To R. S. RANKIN, Mgr. San. Sales, Dorr Co.; the Kenneth Allen Memorial Award for the outstanding meritorious research paper published in *Sewage Works Journal* by a member of NYSSWA. Mr. Rankin's paper appeared in the May, 1948, *Journal* and was titled "Sludge Digester Capacity Requirements." The award was accepted for Mr. Rankin, who is in

Secretaries

Incoming	Outgoing
R. C. Sweeney	*A. F. Dappert*
Reg. Engr.	*Prin. San. Engr.*
N. Y. Health Dept.	*N. Y. Health Dept.*
Rochester, N.Y.	*Albany, N.Y.*

Europe, by Allan Darby of the Dorr Co.

To WILBUR N. TORPEY, Civil Engr., New York City Dept. of Public Works; the Lewis V. Carpenter Memorial Award for his paper on plant operation "outside of normal routine." Mr. Torpey's paper which appeared in the Sept. 1948 *Journal* was titled "Practical Results of Step Aeration."

Vice Pres.
John W. Johnson
Supt.
Sewe. Treat. Wks.
Buffalo, N.Y.

Treasurer
J. C. Brigham
Sr. San. Engr.
State Dept. Health
Albany, N.Y

Business Sessions

The Association secretary usually continues in office, but A. F. Dappert declined reappointment because pressure of his duties as Prin. San. Engr. in the N.Y. State Health Dept. prevent his continuance in office. New officers elected for the ensuing year are:

President
Paul E. Bardet, Engr. in Charge
26th Ward Sewage Plant
New York City

Vice President
John W. Johnson, Supt.
Sewage Treatment Works
Buffalo, N.Y.

Executive Secretary
Ralph C. Sweeney, Reg. Engr.
N.Y. State Health Dept.
Rochester, N.Y.

Treasurer
J. C. Brigham, Sr. San. Engr.
N.Y. State Dept. of Health
Albany, N.Y.

Three new members were elected to the Executive Committee: Western Section—J. T. Howson, Supt., Westfield, N.Y.; Central Section—J. M. MacCrea, Mfrs. Agent, Syracuse, N.Y.; and Long Island Section—W. G. Sweeney, Hempstead, L.I.

Mr. Dappert discussed an amendment passed by the Executive Committee of the Association requiring that dues of members be increased by $2.00 per year in order to raise the contribution to the Federation to $5.00. This change, requiring an affirmative vote of two-thirds of the active members present, was passed unanimously.

Reports were presented by J. McClure Wardle, President, New York Section AWWA, and Rolf Eliassen, Chairman, Special NYSSWA Committee to study the bill sponsored by the Legislative Committee of which Assemblyman Ostertag is chairman. Motion was made that both the NYSSWA and the N.Y. Section AWWA take a stand favoring passage of this bill as the best method to accomplish correction and control of stream pollution. Both motions were carried, and the approval of both Associations in favoring enactment of the bill will be reported to the legislature.

Luncheon Speakers

Federation	A.W.W.A.
W. H. Wisely	*L. H. Enslow*
Exec. Secy.	*"Water & Sew. Wks."*
F. S. W. A.	*New York City*
Champaign, Ill.	*(Pres. A. W. W. A.)*

Sea Water and B.O.D.

"The Effect of Sea Water on the Bio-chemical Oxidation of Sewage" was the title of a paper presented by Harold B. Gotaas, Profes-

sor of Sanitary Engineering, University of California, Berkeley, Calif.

Citing studies reported by earlier investigators of this subject, Professor Gotaas stated their results did not agree—and left the question un-

Program

Rolf Eliassen
Prof. San. Engr.
N. Y. Univ.
New York City

H. A. Faber
Res. Chem.
Chlorine Inst.
New York City

decided as to whether sea water would or would not depress the first stage oxygen demand in the B.O.D. test. In the studies which he carried out, using bicarbonate dilution water (the standard at that time), a number of separate tests were devised in order to check the different factors which might affect results. The methods used included a wide range of dilutions, from 3 to 100 per cent sea water, and of temperature, from 5 to 20 degrees C. Slides were projected to illustrate the results.

Sea water was found to have little effect on the ultimate first stage demand of sewage. At 20 degrees C., the difference between dilutions was so slight that results could not be plotted. The effect of sea water on the second stage B.O.D. consistently indicated increasing inhibition of oxygen demand to occur with increasing concentrations of sea water. Professor Gotaas concluded that the apparent value of "k" is slightly depressed, not significantly in the first stage of B.O.D., but somewhat retarded in the second stage. The importance of these results was stressed in discussion by PROFESSOR VELZ, Head, Civil Engr. Dept., Manhattan College, who pointed to the need for data of this nature in connection with treatment of sewage at New York City.

Anaerobic Waste Treatment

"A NOVEL HIGH-RATE ANAEROBIC WASTE TREATMENT SYSTEM" was described in a joint paper presented by Harry W. Gehm, Technical Advisor, National Council for Stream Improvement, New York, N. Y., and Philip F. Morgan, formerly Chief Development Engineer, National Council for Stream Improvement, now Associate Professor of Sanitary Engineering, University of Iowa. Their paper was discussed by EUGENE H. TRUBNICK, Sanitary Chemist, Anheuser-Busch, Inc., Old Bridge, N. J.

Because of excessive cost for aerobic treatment methods of wastes possessing a high organic load, new interest is developing in anaerobic digestion methods—especially since it has been learned that high rate treatment is applicable to these methods. Dr. Gehm, who presented this paper, noted that wastes which appear best adapted to high-rate anaerobic treatment are those whose characteristics include: an initial B.O.D. in excess of 500 ppm., a nitrogen to carbon ratio of at least 1 to 20, a strong buffering action, relative freedom from settleable suspended solids, a pH value near neutrality, and no inhibiting substances.

Strawboard wastes have been found to meet these requirements. Since they also have the advantage of being relatively high in temperature, it was decided to make laboratory investigations of treatment by this method. The results showed that continuous agitation was necessary and that best results were obtained at high temperatures. Under ideal conditions, a B.O.D. reduction of 90 per cent was obtained and the seed sludge neither increased or decreased. Subsequent pilot plant studies indicated the need for a clarifier to prevent mechanical loss of sludge when liquor was withdrawn. The most efficient design for a full scale plant, now constructed and recently placed in operation, appeared to be one providing anaerobic digestion on a scheme similar to an activated sludge plant. Continuous sludge return facilities, gas storage, and gas metering are included. This plant has a total capacity of 27,000 cu. ft., of which 20,250 are for digestion and 6,750 are for clarification.

Mr. Trubnick, in discussing high rate anaerobic treatment, emphasized thorough contact of waste and sludge at all times to be imperative. This method is applicable to wastes as low as 400 to 700 ppm. B.O.D. Speaking with particular reference to yeast wastes, he stated seed sludge had been found perfectly viable after five years of use. Agitation may not increase total gas production, but materially benefits the rate of gasification.

Programmers

H. W. Gehm
Nat. Council
Tech. Advisor
New York City

E. H. Trubnick
Chemist
Anheuser-Busch
Old Bridge, N.J.

Programmers

H. B. Gotaas
Prof. San. Engr.
Univ. of Calif.
Berkeley, Calif.

C. J. Velz
Hd. Civ. Engr.
Manhattan Coll.
New York City

Trubnick has found plant loading to be the most accurate yardstick in evaluating plant operation: there is a general decrease in efficiency with increased loadings. That is, purification accomplished is determined by a detention time and performance ratio. In discussing results obtained with and without agitation, he stated an 80 per cent B.O.D. reduction may be accomplished under quiescent conditions in 15 to 17 days, or with continuous agitation in 1.5 days.

Standard Methods

"A REPORT ON PLANS AND PROGRESS FOR THE TENTH EDITION OF STANDARD METHODS" was made by Harry A. Faber, Chairman, Joint Editorial Board. The next edition of "Standard Methods" is to be a joint enterprise of the APHA, the AWWA, and the FSWA. To facilitate its preparation, each sponsoring association has appointed one representative to the Joint Editorial Board. The representative will be assisted by a standard methods committee of his respective association, and these committees are now appointed and starting to function. Mr. Faber requested Dr. Hatfield, the Federation representative on the Editorial Board, to discuss progress made by his committee.

Francis B. Elder, Engineering Associate, The American Public Health Association, New York, N. Y., presented a sound motion picture film titled, "TOWARD A UNIFIED PLUMBING CODE." In line with its title, this film showed how careful evaluations had been made of full scale fixtures (basins, bathtubs, and toilets) and of their inter-connections by means of drains, in order to determine safe standards for pipe sizes, slopes, and types of connections.

Federal Pollution Control

"The Federal Works Agency and Water Pollution Control" was discussed in a paper by Major General Philip B. Fleming, Administrator, Federal Works Agency, Washington, D. C. In the absence of the author this paper was read by Mr. Paul Opperman, Urban Planning Officer of the FWA.

Public Law 845 and the role of the Federal Works Agency under this legislation were reviewed in detail. Under the supervision and direction of the Federal Security Administrator, both the Surgeon General of the Public Health Service and the Federal Works Administrator have been given definite responsibilities and authority. The Public Health Service is to draw up comprehensive programs for reducing the pollution of interstate waters.

The FWA administrator is to make loans to state and local governments for the construction of necessary treatment works, for the preparation of reports, plans, and specifications; and to make grants to finance the cost of studies and designs preliminary to the construction of projects. The bill (S-418) which provided the present Public Law authorizes for each of five successive fiscal years, beginning July, 1948, the sum of 22.5 million dollars for construction loans and 1.0 million dollars for grants for planning. So far no funds have been appropriated for these purposes.

That there is a need for Federal aid, and that it can give a real impetus to the advance planning of public works has been demonstrated. The Bureau of Community Facilities administered such a program under the War Mobilization and Reconversion Act. As of June 30, 1948, the Bureaus had advanced some 59 million dollars to states and municipalities to plan needed public works. Plans for some 7,100 projects are underway, and represent a building program estimated to cost nearly 2.5 billion dollars of non-Federal funds.

N. Y. City Sewage Treatment

"The 26th Ward Sewage Treatment Works, Brooklyn, N. Y."

N. Y. Sect. A.W.W.A.

Chairman
J. McC. Wardle
Supt. Pub. Wks.
Hudson, N.Y.

Secretary
R. K. Blanchard
Vice Pres.
Neptune Meter Co.
New York City

was the subject of a paper presented by S. W. Steffensen, Project Manager and Deputy Chief, Bureau of Sewage Disposal Design, Dept. of Public Works of the City of New York.

The historic 26th Ward Sewage Treatment Plant, now more than 50 years old, will be replaced sometime during 1949 by a new plant on the same site. Partial treatment is now provided by prechlorination and primary sedimentation. The new plant will employ the activated sludge process with chlorination. The history of this old plant, designed in 1888 to treat 3 mgd. and overloaded when first placed in operation in 1897, will make a valuable record when Mr. Steffensen's paper is published. It first used lime coagulation, settling, and chlorination; the chlorine was produced on the site by the Powers process (salt, potassium permanganate, and sulfuric acid).

Activated sludge treatment has been adopted for the new plant because of the land-locked nature of the receiving waters. The sewage, predominately domestic, will receive three and one-third hours of aeration (including 25 per cent return sludge). Provision is made for step aeration. Other facilities will include: sludge thickening units, sludge digesters, and pumps to discharge sludge to sludge vessels, to drying beds, or to a future fertilizer plant. Approximately three-quarters of the electric power requirements will be furnished by generators operated from sludge gas. The plant is designed for treatment of 60 mgd., to serve an estimated 480,000 (in 1970). It will include a chlorine building to store 41-ton containers and will be provided with unusual safety equipment.

Inspection Trip

On Saturday following the Friday joint sessions, an inspection trip was held for the members of the three associations. The trip was made to the 26th Ward Sewage Plant which Mr. Steffensen had described.

This project will serve the East New York and Brownsville Districts of Brooklyn. It is being pushed to completion by the Department of Public Works as one of the important steps in the clean-up of Jamaica Bay. Upon completion of this plant late in 1949 and the Rockaway Treatment Works scheduled to be put into service in 1950, an appropriate type of sewage treatment will have been provided for all areas fronting Jamaica Bay and no longer will untreated city sewage be discharged into this great body of water. This elimination of raw sewage pollution will bring closer to realization a Jamaica Bay restored as a recreational area, an achievement which has long been the goal of city authorities and the public alike.

The new plant is located at the head of the Hendrix Street Canal about 3,000 feet inland from Jamaica Bay, and will serve a drainage area of approximately 6,000 acres.

MALCOLM PIRNIE RECEIVES HIGH ENGINEERING HONOR

The Hoover Medal "for distinguished public service" has been awarded to Malcolm Pirnie, prominent New York consulting engineer. This award is sponsored by the four major engineering societies representing the civil, mechanical, electrical and mining engineering professions.

Mr. Pirnie was honored through presentation of the Hoover Medal for his work which had as an objective obtaining wider recognition of the value of the engineer in the solution of national and international problems. In this he was instrumental in

formation of the Engineers Joint Council, and served as chairman of its Executive Committee. In this capacity he had a major role in a report which was used as an important guide in the industrial disarmament of Germany and Japan.

Mr. Pirnie has the distinction of being a past-president of the A.S.C.E., and A.W.W.A. The last named also awarded him its Diven Medal and bestowed on him Honorary Membership, in recognition of his long services to the Association as Chairman of its important Water Works Practice Committee. In the line of public service, Mr. Pirnie also enjoys the distinction of having served as Mayor of Scarsdale, N.Y.

EUROPEAN SANITARY ENGINEERING IMPRESSIONS

by

DR. J. V. N. DORR
Chairman of the Board
THE DORR COMPANY
NEW YORK

The Author and Friends

Dr. Dorr with members of the Staff of Dorr-Oliver Ltd. of London at the company's Forest Hills Laboratories.

DURING the past summer it was my lot to make a quick trip through Europe reaching as far north as Sweden, and as far south as Venice, Italy. The objects were two-fold—to renew old contacts and establish new ones with our associates in Europe and with many of their customers and clients; and to assist in obtaining material for a new movie, "The Story of The Dorr Co.", which it was decided we should make. Most of the journeying was done in a station wagon which clocked 5,500 miles. Scandinavia, however, was done by air, train, and local cars.

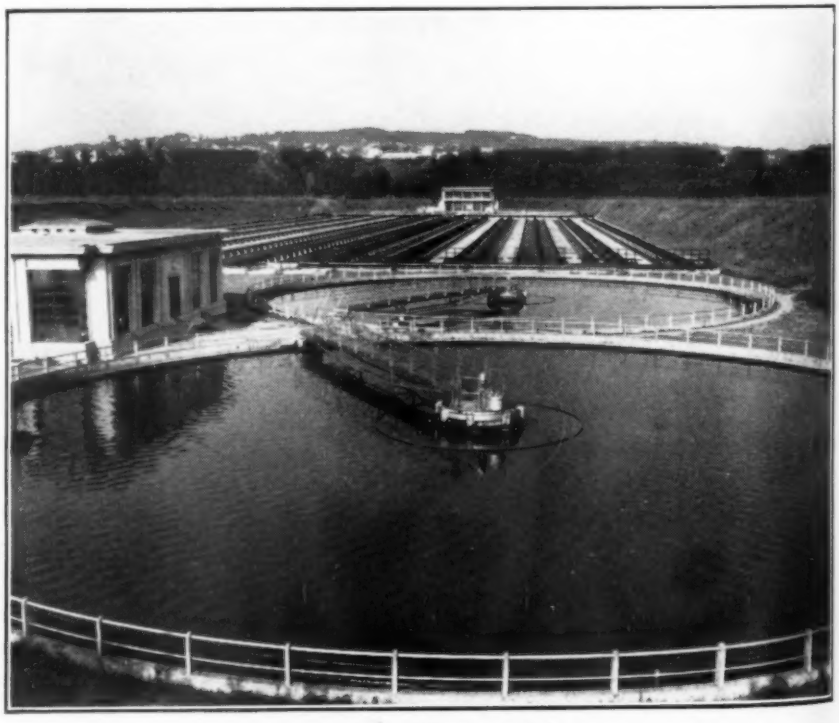
With the objectives named my contact with sewage and water developments was naturally very hurried, but included visiting historic small plants like Cheam Sutton in Surrey, England, where plant mechanization in part had its initial demonstration in England; also, visited a few big plants like that at Aschere, serving Paris and completed during the war, and the Colne Valley plant, contracted before the war but delayed on account of it, and now scheduled for completion in 1950.

Operations

How much of every-day life goes on during war and occupation impressed me greatly. The shortage of labor, together with occasional bomb damage had required much sacrifice and ingenuity to keep things moving. Even the by-products of sewage purification were used in warfare at certain places. In Stockholm, London and a few other places digestion gases were used to operate city transport.

In some areas much engineering time had been spent on planning and studying conditions and development. For instance, the increased population around Switzerland's famed Lake Zurich is gradually polluting the waters of that beautiful lake, and correction of such desecration will be required.

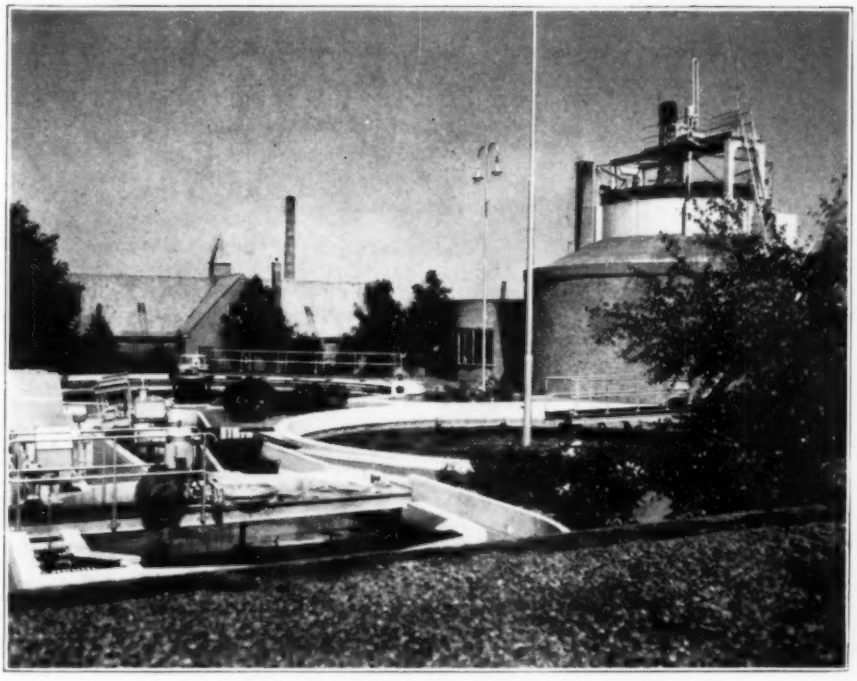
Changes in population densities have increased demands on cities. In



The Acheres Plant of Paris

A flexible modern activated sludge plant completed during the German occupation in World War II.

England the fundamental problem of holding people on the land, and stopping the drift to the cities, has caused study of the use of scattered small plants to better the living conditions in rural areas. The enormous economic waste in water-borne sewage disposal seems hard to impose on such a weakened economy as exists in Europe today, but no other method seems socially acceptable.



The Activated Sludge Plant of Hilversun, Holland

Unique Kessener rotating brushes provide aeration. Dorrco digesters are equipped with rotating heating-grids.

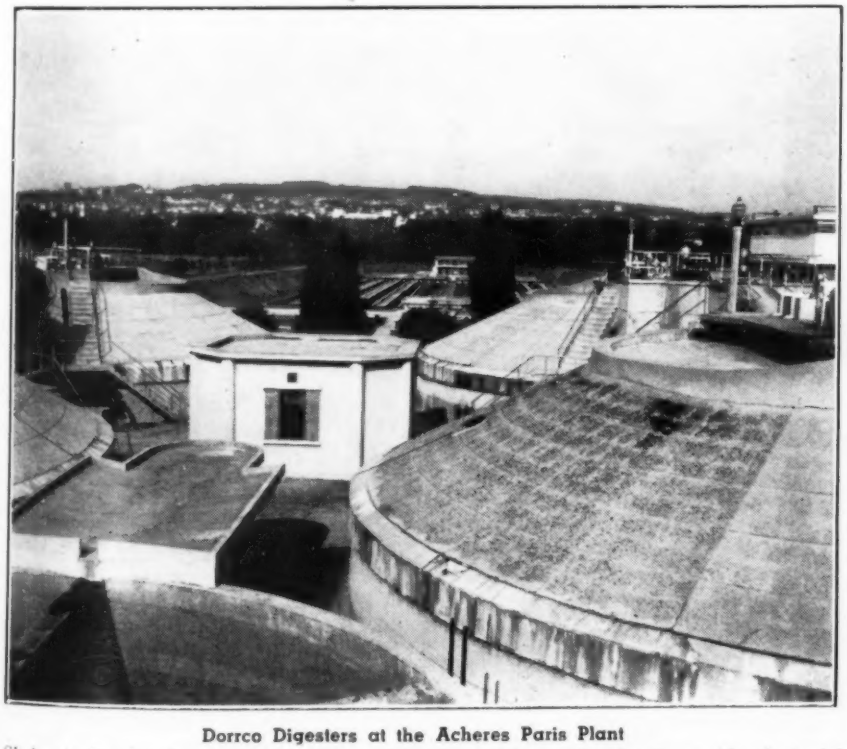
Plants

The Colne Valley system mentioned earlier is noteworthy as the first large-scale plant in Europe to provide for the practice of sludge incineration or drying of sludge for marketing as fertilizer, as circumstances dictate at the time. Also, the activated sludge may be digested or vacuum filtered with primary sludge at will. Elutriation will be employed so as to reduce the requirements of chemical sludge conditioners. Another interesting feature is the use of the recently perfected dual-fuel gas engines.

The extent of population growth is shown by the fact that, although the Colne Valley system was planned before the war with what was considered ample margin, they will have to start on an addition even before the plant gets into operation next year.

The Acheres plant of Paris is also of the activated sludge type. This plant is very modern in design; an unusual feature is the use of air injection nozzles instead of conventional diffusers for introduction of air in the aeration tanks. Sludge is preheated and digested in units equipped with stirring mechanisms.

At Hilversun, Holland, there are two modern plants. One uses activated sludge with the Kessener type brushes to provide the aeration and sludge circulation; the other employs trickling filters. At the latter plant considerable improvement in final settling is obtained by flocculation in a combination type flocculation-clarification unit.



Dorrco Digesters at the Acheres Paris Plant

Sludge preheating is amplified by internal heating with rotating heating-grids of special design.

Some very interesting experimental work is being carried out at the Zurich plant in Switzerland, where short period activation with the addition of asbestos (Zigerli Process) is being compared with high-rate filters of the enclosed and recirculation types.

The industrial belt across Northern England and Lower Scotland has done much with small plants, and we visited several. The operators and engineers took great pride in them and the flower gardens and general character of installations made show places of a number of them. One operator showed me a pump which he boasted "had not had a spanner to it in ten years."

While France would seem the most difficult country for much advance, the beautiful plant at Acheres was planning an addition as soon as the present plant came into complete use, and we saw a shovel starting on a project for Versailles on the site of a settling basin which had been built by Louis XIV.

Stockholm on the sea has a complete plant for a small working section tucked away largely underground in a crowded neighborhood.

AEROBIC TREATMENT OF RUM WASTES*

by

CLAIR N. SAWYER[1] AND EARL J. ANDERSON[2]
Sedgwick Laboratories of Sanitary Science
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

RUM wastes belong to that group of by-products which are known in the distilling industry as "beer slop" and which comprise a major part of the class of wastes now generally referred to as fermentation residues.

Beer slops are produced largely from the fermentation of cereals and of molasses. In either case the slop produced is rich in organic matter and possesses a very high biochemical oxygen demand (B.O.D.), usually ranging from 10,000 to 40,000 ppm.

Because of the high pollutional character of these wastes, a great deal of study has been directed to their recovery as marketable by-products or to stabilizing them in a satisfactory manner before final disposal. These studies have resulted in recovery methods for slops from fermentation of cereals which will pay their way and may even produce a profit when the solids in the waste exceed 5 per cent[2]. For more dilute wastes, anaerobic digestion followed by trickling filter treatment is the preferred method[1].

The disposal of beer slops produced in the fermentation of molasses is quite another problem and in most cases methods have not been developed which will yield returns comparable to the cost. Evaporation and drying results in a residue with considerable food value but possessing several undesirable characteristics[3]. The residue produced in the evaporation of slops from butanol-acetone fermentation is sold largely for its riboflavin and other B-complex vitamins [4]. Anaerobic fermentation followed by trickling filter treatment has also been applied to slops from fermentation of molasses[2].

The Rum Industry

There are five distilleries in the United States which produce rum. One is in Kentucky, one in Pennsylvania and the other three are located in Massachusetts. To our knowledge,

The Senior Author

none of these practice any form of recovery or treatment of their wastes. Of the three in Massachusetts, two are at tidewater and dispose of their stillage into municipal sewers with final disposal by dilution in the ocean. The third plant is located some forty miles inland on a small stream and to avoid pollution of the stream has also disposed of its waste into the municipal sewer system. The combined wastes of the city and industry are treated at the local treatment plant which consists of sand filters.

Operating Difficulties Caused by Rum Wastes

Because of operating difficulties which developed at the sewage treatment plant, largely sealing of the sand beds, and pollution of the receiving stream by improperly treated sewage, the State Health Department issued a restraining action against the industry forbidding it to dispose of the wastes in the municipal sewers until some remedial measures had been developed.

At this particular distillery, the manufacture of rum is not carried on continuously throughout the year and the volume of waste produced per day is only about 12,000 gallons or 1 per cent of the domestic sewage flow. These factors combined with present tax policies on capital investments for waste treatment facilities and the absence of a sewer rental law in the city in question make disposal and treatment at the municipal works a highly desirable situation from the standpoint of the industry.

The great variation in sewage strength occasioned by the presence or absence of 1 per cent of rum waste in domestic sewage would seem to be a situation which could be best handled by high rate trickling filters with rates of application and recirculation adjusted to the varying load. Consequently, we chose to investigate the use of a two-stage system of the Biofilter type for this situation.

EXPERIMENTAL PROCEDURE

Nature of Rum Plant Wastes

Since practically no information was available on the nature of beer slop from rum plants, we obtained samples from all 5 of the plants and subjected them to analysis. The results obtained are given in Table I. From this table it will be seen that the total solids varied from 5.33 to 7.78 per cent, being about 75 per cent volatile and over 90 per cent in a dissolved condition. The 5-day B.O.D. varied from 24,500 to 50,000 ppm. when measured with a supplemented phosphate dilution water. These data are in fair agreement with those published by Hoover and Burr[5] for distillery wastes from molasses and serve to illustrate that the waste under investigation, "E," was representative of those produced in the industry.

Table I
CHARACTERISTICS OF RUM PLANT WASTES

Determination		Source of Rum Waste				
		A	B	C	D	E
Total Solids	%	5.33	7.78	6.13	7.01	7.12
Volatile Solids	%	75.6	83.8	74.3	72.9	75.2
Suspended Solids	ppm.	5,976	2,232	5,472	4,072	2,470
Ammonia Nitrogen	"	36.5	1.0	1.5	4.0	1.5
Organic Nitrogen	"	718	555	643	514	893
Oxygen Consumed	"	18,400	34,350	22,500	23,900	26,000
B.O.D.—5 day	"	24,500	50,000	32,200	47,100	31,700
pH		4.15	3.68	4.50	3.84	4.75

*A paper presented before the Soc. of Amer. Bact. Symposium on Microbiological Utilization and Stabilization of Industrial Wastes, and released for publication here.

[1]Associate Professor of Sanitary Chemistry.

[2]Research Associate in Sanitary Engineering.

Biofilters

A two-stage Biofilter was erected in our laboratories according to the plan shown in Fig. 1. The filters were constructed using 4 inch inside diameter pyrex pipe and filled to a depth of 3 feet with regular size filter rock (1½ to 2½ in.) taken from the filters at Fitchburg, Mass.

The experimental plant consisted of a preliminary settling tank, first stage filter, intermediate settling tank, second stage filter and final settling tank. Boston sewage containing 1 per cent of rum waste was fed to the plant. Recirculation of final effluent to the preliminary settling tank was in the ratio of 3 volumes of effluent to 1 volume of sewage. Application of sewage and recirculated effluent to the filter was at the rate of 15.3 mil.gal./acre/day and the B.O.D. loading was at the rate of 2,590 lb. per acre ft.

The rum wastes caused such a prolific growth of Sphaerotilus and other growths in the preliminary settling tank that stoppages resulted in the rubber tube connections leading to the first stage filter. To overcome this difficulty, the rum waste was added directly to the dosing device on the first stage filter by means of a constant head siphon.

Experimental Run Duration

To expedite proper bacterial growth in the filters, filter stones with biological slimes attached were secured direct from the filter beds at Fitchburg, Mass. Due to changed temperature and environmental conditions in the laboratory, however, it took approximately three weeks of constant operation before the filters quit sloughing and settled down to consistent operation. The filter was operated for a period of 40 days and analyses of the influent and effluent for B.O.D., suspended solids, ammonia nitrogen and organic nitrogen were made during the last 20 days of the run.

It should be mentioned that the filters were operated indoors at temperatures comparable to summer operating conditions.

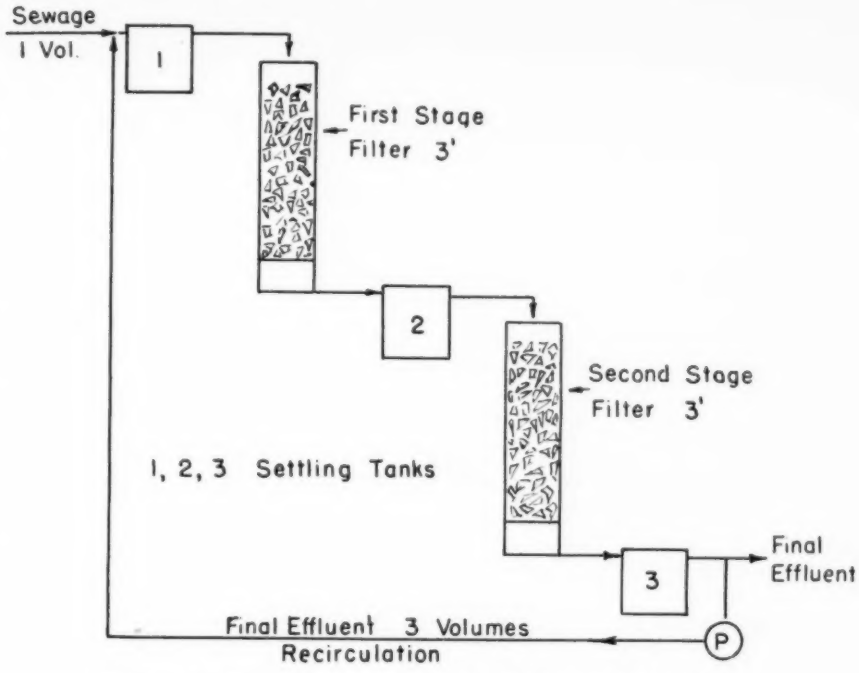


Fig. 1—Two Stage Filter System Used and Scheme of Recirculation

Experimental Results

The results of B.O.D. determinations are given in Table II. These data show the overall B.O.D. removals, for the plant, averaged 95.9 per cent. The influent B.O.D. averaged 485 ppm. and the effluent B.O.D. averaged 19.7 ppm. Maximum final effluent B.O.D. was 31 ppm. The consistent behavior of the filter during the last 18 days of the run shows the filter was operating in a well stabilized condition.

Table II

B.O.D. Removals By Trickling Filter Treatment of Domestic Sewage Containing 1 Per Cent Rum Waste

Date	B.O.D. Influent ppm.	B.O.D. Effluent ppm.	B.O.D. Reduction %
12-12-46	506	10	98
13	510	5	99
14	505	23	95.5
15	505	28.5	94.5
16	511	30	94.2
17	527	31	94.1
18	482	16	96.7
19	494	18	96.5
21	411	26	93.7
22	365	21	94.3
23	457	18	96.1
24	487	16	96.7
26	459	27	94.2
28	503	11	97.6
31	524	13	97.5
1- 1-47	516	22	95.7
Avg.	485	19.7	95.9

Two composited samples were collected and analyzed for suspended solids, ammonia nitrogen and organic nitrogen. The results are shown in Table III. These data show that a very good removal of suspended solids was accomplished. The presence of from 1 to 3 ppm. of ammonia nitrogen in the final effluent indicates that sufficient nitrogen existed in the mixture being treated to satisfy the synthetic requirements. The organic nitrogen content of the final effluent was unusually high but, since the B.O.D. values were low, it indicates that the compounds containing the organic nitrogen were quite resistant to bacterial oxidation.

Table III

Biochemical Changes Produced By Trickling Filter Treatment of Domestic Sewage Containing 1 Per Cent Rum Waste

Determination	Influent ppm.	Effluent ppm.	Reduction %
Suspended Solids			
Composite Dec. 14-20	91*	10	89
" Dec. 21-27	79*	15	81
Ammonia Nitrogen			
Composite Dec. 14-20	14.0	1.05	92
" Dec. 21-27	11.0	1.00	91
Organic Nitrogen			
Composite Dec. 14-20	19.7	6.51	67
" Dec. 21-27	19.2	6.75	65

*Fine screened sewage was used to minimize clogging of rubber tube connections.

DISCUSSION

The disposal or treatment of industrial wastes in a satisfactory manner by aerobic methods is limited by a number of factors of which the following seem to be most significant:

Satisfaction of Nutritional Requirements

Aerobic treatment methods to be economical depend upon rapid assimilation and conversion of the organic wastes to new organic forms (trickling filter slimes or activated sludges) which have a density greater than that of the carriage water and can be settled out in sedimentation tanks. Thus, the organic matter is removed from the liquid phase with a minimum of oxidation.

The conversion of dissolved, colloidal, or suspended organic matter to

a living biological sludge with desirable properties depends upon having available for the synthetic activity a sufficient supply of certain nutrient elements of which nitrogen and phosphorus are indispensable. If the waste waters under consideration do not carry the necessary complement of these elements, they may be supplied by making mixtures with domestic sewage which contains excess nitrogen and phosphorus or the nutrient elements can be added as ammonium and as phosphate compounds.

From data previously published by the senior author[7], the nitrogen and phosphorus requirements for stabilizing a high carbohydrate waste were found to be approximately 1 ppm. of phosphorus and 3 ppm. of nitrogen for each 45 ppm. of B.O.D. More extensive studies of these requirements are now under way in our laboratories and present indications are that the previously published results are on the generous side as far as the nitrogen and phosphorus are concerned. Data obtained with activated sludge while stabilizing a 1 per cent mixture of rum waste in domestic sewage indicates that only one part of nitrogen need be supplied for each 30 ppm. of B.O.D.[8].

Limiting B.O.D. of Feed Mixtures

It has been long recognized that the addition of sewages with high pollutional strength to trickling filters and activated sludge plants results in unsatisfactory operation. In general, it may be stated that the limiting strength is from 300 to 500 ppm. of B.O.D. In the case of standard rate trickling filters, the difficulties usually exhibit themselves in a profuse growth on the surface stones which becomes continuous and causes plugging of the interstices so that the liquid wastes can not filter through the bed in a normal manner. Ponding or pooling is the result. To overcome this difficulty, recirculation of effluent has been practiced to reduce the strength of the sewage as applied to the filters and to distribute the food load to greater depths.

With activated sludge treatment, difficulties in operation originate from two sources. Firstly, the strong wastes may cause such a high demand for oxygen when coming in contact with the activated sludge that reasonable dissolved oxygen levels can not be maintained and, consequently, less desirable facultative organisms proliferate. Secondly, the high food load may cause such rapid growth of the sludge that the average age of the sludge may approach that of primary sludge solids with little clarifying and purifying ability. This latter difficulty may be overcome by increasing the aeration solids to higher levels so as to increase the amount of oxidation while decreasing the synthetic (growth) activity of the sludge, but the upper limit of solids which can be carried in a system is usually limited by such factors as sludge removal capacity of final clarifier mechanisms and by the supply of air for aeration.

To handle sewages of high B.O.D. in a satisfactory manner by activated sludge, high rates of return sludge have been practiced with varying degrees of success. Beneficial effects are probably a result of shorter storage time in the final clarifiers and of dilution of the strong waste. Return sludge rates as great as 65 per cent of the sewage flow have been used in this country. Dr. Kessener reports that return sludge rates as high as 400 per cent of the sewage flow have been used on certain high B.O.D. wastes in Holland[6].

Maintenance of Aerobic Conditions

The addition of strong industrial wastes with a high percentage of its organic matter in a dissolved form to municipal sewers often results in such a rapid stimulation of biochemical activity in the resulting mixture that all oxygen resources are depleted and anaerobic conditions develop. Similarly, when such mixtures of wastes are detained in preliminary settling tanks for separation of settleable solids, the absence of oxygen allows further development of anaerobic changes. The addition of wastes which have undergone such anaerobic degradation to aerobic biological treatment facilities as trickling filter or activated sludge plants has often resulted in unsatisfactory operation.

To overcome these difficulties, whenever possible strong wastes should be transported to the sewage treatment plant separately and added to the treatment process at a proper location. In case such a procedure is not feasible, control of biological changes in the sewer system and preliminary settling tanks may be accomplished by the addition of a bacteriostatic agent such as chlorine, or oxygen resources may be added in the form of nitrates to prevent the development of strict anaerobic conditions.

High recirculation rates of final effluent through the preliminary tanks will assist in maintaining aerobic conditions through the dissolved oxygen and any nitrates and nitrites which may be contained in the effluent.

Summary

At a rum distillery in Massachusetts, disposal of beer slop into municipal sewers resulted in gelatinous sealing of the sand filters at the sewage treatment plant. Distillery wastes approximated 1 per cent of the sewage flow.

Mixtures of sewage containing 1 per cent of the distillery waste were satisfactorily treated in an experimental two stage Biofilter plant using a recirculation ratio of three volumes of final effluent to one volume of sewage. The influent B.O.D. averaged 485 ppm. and the final effluent B.O.D. averaged 19.7 ppm. A 95.7 per cent removal was accomplished. The loading on the filter was at the rate of 2,590 lb. of B.O.D. per acre foot.

Aerobic treatment on high rate filters in conjunction with domestic sewage is a reasonable method of treatment in the instance cited because of factors peculiar to the situation.

References

1. Bird, H. R. and Mattingly, J. P., "Fermentation Solubles in Diets for Growing Chickens," *Poultry Sci.*, *24*, 34 (1945).

2. Boruff, C. S., "Waste Problems in the Fermentation Industry," *Ind. Eng. Chem.*, *31*, 1335 (1939).

3. Boruff, C. S., "Recovery of Fermentation Residues as Feeds," Ibid, *39*, 602 (1947).

4. Buswell, A. M., "Biological Processes for Treating Wastes," Ibid, *31*, 1349 (1939).

5. Hoover, C. R. and Burr, F. K., "Distillery Wastes," Ibid, *28*, 38 (1936).

6. Kessener, H., Private communication.

7. Sawyer, C. N., "B.O.D. Removal from Waste Sulfite Liquor—Sewage Mixtures by Activated Sludge," *Ind. Eng. Chem.*, *33*, 411 (1941).

8. Unpublished data, Sedgwick Laboratories of Sanitary Science.

"Bob" Merz Joins Univ. of Wisconsin Staff

R. H. (Bob) Merz has joined the teaching staff of the Hydraulic and Sanitary Laboratory staff of the

College of Engineering at the University of Wisconsin in Madison, Wis.

Mr. Merz was formerly a sales engineer with the Chain Belt Co. for the past fourteen years.

At the University of Wisconsin he is teaching sewage treatment plant design and hydraulics.

AN INTRODUCTION TO THE MICRO-BIOLOGICAL UTILIZATION AND DISPOSAL OF WASTES*

by

A. M. BUSWELL

Chief

ILLINOIS STATE WATER SURVEY

URBANA, ILL.

IN introducing the topic of waste utilization, it appears in order to call attention to the main purpose of sewage treatment. Sewage is treated primarily to prevent nuisance. Disease organisms which commonly accompany pollution can easily be destroyed by chlorine disinfection once the large load of organic matter has been removed. Nuisance is caused primarily by the presence of unoxidized carbon and hydrogen. Compounds containing these elements in unoxidized condition decompose as a result of bacterial activity to consume oxygen in streams or lakes, and eventually to reduce sulfates to sulfides. The sulfides and decomposed organic residues produce the characteristic odors of putrefaction which result in nuisance.

Just so far, then, as unoxidized carbon and hydrogen can be removed from waste liquors, our problem of sewage treatment has been accomplished. If carbon and hydrogen can be produced in the form of alcohol, lactic acid, vanillin, methane, or any other valuable organic compound, the sale of such compound may offset the cost of waste treatment.

This paper is directed toward the discussion of applications of bacteriology to the recovery of such valuable products from liquid wastes, whether they be so-called municipal sewage or industrial trade wastes. In order to complete the picture and make a more rounded presentation of the whole problem, we would like to briefly review some of the uses of waste waters.

Fertilizer Recovery

One of the oldest attempts at the use of wastes is the recovery of fertilizer. As is well known, excreta contains considerable amounts of available nitrogen, which is a very important plant food. The Chinese probably have the most effective method for the recovery of nitrogenous material. This consists in the collection of excreta in dry latrines with tight containers

The Author

which makes possible the transportation of the undiluted material direct to agricultural land. This method introduces bacteriological problems, since the consumption of fresh vegetables on lands so fertilized is a well known method of transmitting intestinal diseases, including both the amoebic and bacillary type of dysentery.

The more modern method of removal of wastes by water carriage presents an entirely different picture. With such systems the wastes are usually diluted with from 50 to 150 gallons of water, so that even strong domestic sewage contains less than .05 per cent of organic matter. In other words, strong domestic sewage is 99.95 per cent pure, which exceeds the purity of a certain well advertised soap. With this high dilution the cost of concentration of the nitrogenous material exceeds the cash value of the fertilizer.

An early attempt to utilize sewage, which may be defined as the water-carried wastes, was the development of sewage farms. In this case the sewage, after removal of coarse fibrous and granular material, is distributed over the land through irrigation ditches supplying both moisture and some plant food. In arid regions, as for example, the area near the City of Denver, Colo., the value of the moisture is of prime importance and the process is in general successful.

On the older sewage farms such as those operated by the City of Paris and the City of Berlin, the amount of moisture was sometimes greater than the soil required and sour and soggy land resulted.

Another example of the use of sewage as a fertilizer is the development of fish ponds in the vicinity of Munich, Germany. Here carp, which depend on aquatic vegetation for their food supply, are successfully raised. Sewage, after the removal of coarser particles, serves to fertilize and stimulate the growth of aquatic vegetation, and of course by just so much as the organic material is removed from the water, purification is accomplished.

Sludge Recovery

The next development in the recovery of fertilizer was the introduction of purification processes which removed the organic matter in the form of sludge. This sludge, after digestion, is drawn out onto sand beds to be dried. The digestive process liquefies a considerable portion of the nitrogenous compounds so that the sludge is relatively poor in nitrogen, (between 1 and 3 per cent on a dry basis). This sludge contains from 1 to 2 per cent of available phosphoric acid and a small amount of potash. The principal value of this sludge is therefore as a humus material. It is sometimes sold for a fair price where soil in the vicinity requires humus, but in many cases it is impossible even to give it away.

The introduction of the activated sludge process resulted in a much higher recovery of nitrogen since by this process the soluble and colloidal nitrogen compounds are taken up by biological growth which later settles. This process is best described as a bioprecipitation. Activated sludge is chemically treated and artificially dried in considerable quantities at Milwaukee and Chicago as well as several other large cities. This sludge contains 6 per cent of nitrogen, with 3 per cent of phosphoric acid, and is of course of greater value. The total amount of activated sludge sold annually in the United States is approximately 100,000 tons.[1]

Interesting bacteriological problems exist in connection with both the

*Presented as the opening address of a Symposium on Waste Utilization at a meeting of the Society of American Bacteriologists, and released for publication here.

(1) Manual of Practice No. 2: Utilization of Sewage Sludge as Fertilizer. 1946. Federation of Sewage Works Associations.

digestion of settled sludge and the production of activated sludge by bioprecipitation. These are strictly bacteriological processes and advances in their operation have depended upon studies of their flora.

Industrial Wastes

The disposal of industrial wastes and the recovery of valuable products has been handicapped by the large volume of water to be handled. Notable strides in decreasing the volume of industrial wastes have been made in the last 25 years. As examples we may cite starch manufacture and the manufacture of pulp and paper.

In starch manufacture the corn is steeped in water before final grinding for the removal of the starch grains. This water dissolves a considerable amount of gluten which in a dry form has a value ranging as high as $20 to $30 a ton. The liquor from a single steep is too dilute to permit its evaporation and the recovery of the gluten. Introduction of sulfur dioxide prevents the growth of putrefactive bacteria so that the water may be used to steep several batches until its gluten content reaches a value where evaporation is profitable.

In paper making, the fiber, as it goes to the paper machine or pulp drums, is suspended in 95 to 99 parts of water. A certain amount of soluble material is taken up and the water, after the removal of the fiber (so-called "white water"), serves as a medium for the growth of slime-forming bacteria which eventually attack the paper stock. In the last 25 or 30 years the practice of disinfecting the "white water" with chlorine and treating it with certain of the newer bacteriostatic compounds (e.g., certain chlorinated phenols) has made it possible to re-use this "white water" almost indefinitely. This operating procedure results in the saving of a very considerable amount of paper fiber since some fiber always passes through the paper machine screens. Savings of fiber easily amount to $100 per day per machine.

Use of Sewage Effluents

The extremely high demand for water for industrial purposes in the last few years has led to some very interesting developments in the reuse of sewage. This was a subject of a symposium[2] held by the joint meeting of the American Water Works Assn. and the Federation of Sewage Works Assns. in San Francisco in July 1947. Veatch in this symposium cited nine rather large installations where the purified effluent of a sewage treatment plant was used for such industrial purposes as steam raising, cooling, and quenching of steel and coke. Probably the largest such installation is that described by Wolman at the City of Baltimore, where some 20 million gallons per day of reclaimed sewage is used as an industrial water supply.* This development is of interest to bacteriologists, since it presents a very important problem of control of the disinfection of such a large amount of heavily polluted liquor.

Methane Production

In concluding this introduction which has been limited to the rather dilute municipal sewage rather than the concentrated manufacturing wastes, we should mention the increasing use of methane which is produced during the anaerobic stabilization of sludge. This gas has long been used as a source of heat and power in plant operation but recently where large quantities are produced it has been sold to the city gas works where it blends well with the natural gas mixture now being sold through the Midwest.

Methane production from wastes is strictly a microbiological activity, subject to optimum conditions of temperature, pH, rate of feeding, etc. The process involves a decomposition of organic matter with water acting as the oxidizing agent, and the step wise hydrolysis occurring with the release of free energy. Because of the part water plays in the reaction, the weight of the two gases produced, carbon dioxide and methane, is more than the weight of the original organic compounds in most instances.

From the sludge of domestic sewage, the gases produced amount to approximately 1 cu. ft. per capita per day and the gas contains 60 to 65 per cent methane with 20 to 35 per cent carbon dioxide. This anaerobic fermentation process is applicable to many organic industrial wastes, and may be a more profitable treatment than attempts to recover other compounds from dilute wastes.

These subjects of bioprecipitation, and the methane fermentation have many ramifications and each can only be thoroughly presented in a full length article.

(2) *Sewage Works Journal*, V. 20, p. 3-53, 1948.

*The capacity of this plant is now being doubled.

HEDGEPETH JOINS CALCO

L. L. Hedgepeth, formerly executive secretary of the Virginia State Water Control Board, has joined the American Cyanamid Co. as consulting engineer on industrial waste problems.

Mr. Hedgepeth will make his headquarters at the Bound Brook, N.J., plant of the company's Calco Chemical Division.

A graduate of North Carolina State College, Hedgepeth was associated with the North Carolina State and Municipal Health Departments for a number of years, and was later technical service director for the Pennsylvania Salt Co. He has been active in the field of water and waste treatment for a number of years and received the Fuller Award of A.W.W.A. in 1943 and a special testimonial from the Manufacturing

Chemists Association in 1947 for his contributions to literature on water sanitation.

Mr. Hedgepeth was appointed executive secretary of the Virginia State Waste Control Board in 1946, and he organized and headed the technical staff of that organization to administer Virginia's new Stream Pollution Abatement Law.

He is a member of Tau Beta Pi, A.W.W.A., a Fellow of the A.P.H.A., and a director of the F.S.W.A.

Data On Ill. Public Water Supplies

The Division of Sanitary Engineering of the Ill. State Department of Public Health has issued Circular Number 136, which contains data on all of the public water supplies in the State of Illinois.

The bulletin contains such data as population, ownership, date installed, source of supply, kind of treatment, storage capacity, power used, rates, and analysis.

To obtain a copy of this circular, write to C. W. Klassen, Chief Engineer, Division of Sanitary Engineering, State of Ill., Dept. of Public Health, Springfield, Ill.

WE DO OUR DIGGING WITH A "HYDROCRANE"

by
LLOYD D. KNAPP
Superintendent
BUREAU OF SEWERS
CITY OF MILWAUKEE

WHEN it comes to digging storm - inlet overflows and catch-basin trenches—and in our case this happens 500 to 600 times a year—we're always ready with an answer. Our immediate thought is "Hydrocrane," for in one of these new all-hydraulic truck cranes we have found a way to handle such jobs fast and efficiently.

In 1947 we dug 220 catch-basin trenches and 359 storm inlets, many of them with an H-2 "Hydrocrane" equipped with a ¼-yard hydraulic clamshell bucket. Our experience on these jobs and on the even greater number of similar operations handled in 1948 has proved that we can, with the truck crane, do this type of digging much faster and more economically than was possible by the hand-labor method. It has been established that our savings, determined on the basis of labor and equipment costs per foot of trench, run around 30 per cent.

Before this all-hydraulic unit was obtained, we had not found it economical to do this digging with a truck crane. The smallest available machines with enough capacity to handle our jobs were larger than the work required. Their initial and operating costs were relatively high. The "Hydrocrane," on the other hand, seems to be just right in capacity and size. Its initial and operating costs are relatively low, and the latter show consistent savings over former methods employed—principally hand labor. In addition, it is easy to operate and, with its high mobility, can be put into service on short notice as a troubleshooter.

The Author

A Mobile Unit

Mounted on a truck, it can speed to various points in the city, quickly handling a storm-inlet or catch-basin assignment. This feature is especially valuable to us in emergencies occasioned by such things as move-ups in contractors' paving schedules. Our "Hydrocrane" with its accompanying truck can leave one job and start for another location with five minutes' notice. Our hand-digging crews with their trailer-mounted air compressor and their heavy tool and shelter wagon cannot move on short notice because a heavy truck must first be scheduled to pull the units to the new location. This often takes several hours, so with our crane we can immediately move out to an emergency job and frequently have it completed within three hours or before we could even get a hand-digging crew moved to the site.

The model we use is the Bucyrus-Erie H-2 mounted on a 1½-ton International KB-5 truck. For digging it is equipped with a ¼-yard clamshell

Bucyrus-Erie H-2 "Hydrocrane" Used by Milwaukee Bureau of Sewers
(The machine is truck-mounted for mobility and features completely hydraulic operation)

Operator Lowers Bucket To Take Another Bite
(Note how hydraulic outriggers are used to gain extra stability)

bucket. The machine is completely hydraulic—hoist, swing, outriggers, boom, and even the clamshell bucket all operating by means of a simple hydraulic system employing rams. There are no shafts, drums, gears, clutches, brakes, chains, or sprockets; consequently hundreds of wearing parts required for conventional cranes are eliminated.

Power for operating the crane is supplied by the truck engine, which is governor-controlled at about the middle of its normal speed range. A line shaft, extending back through the truck chassis from a power take off on the transmission, drives hydraulic pumps in the crane sub-base through V-belts. The pumps push the hydraulic fluid through the valve bank at the operator's position. From there the fluid is piped directly to the individual rams controlling the various crane functions.

Hoisting is achieved through two vertical hoist rams which push multiple sheaves apart, thus producing line travel. Swing is controlled by hydraulic rams located alongside each leg of the A-frame. The upper deck revolves 370 degrees in either direction. The boom hoist, which is independent of the load hoist end of the swing, is handled by two hydraulic rams anchored in the A-frame and attached to the underside of the boom. The tubular 16-foot boom can be extended to 22 feet at will by means of a double-acting ram. The leveling and stabilizing outriggers are operated by double-acting vertical and horizontal rams.

About 90 per cent of our use of the crane is on digging catch-basin trenches and storm-inlet overflows. We never run out of such jobs because the city is continually building new streets and alleys, paving those which were previously unpaved, or repairing others. The recently completed two-mile section of Third Street, for example, involved digging trenches for 130 catch-basins. The remaining 10 per cent of our use of the machine covers a variety of small jobs, such as digging lengths of trenches for sewers that have broken down, handling pipe, backfilling, and cleaning up. One rainy morning when digging operations were suspended we sent the crane and a truck over to the City Testing Laboratory. In two hours an accumulation of broken sewer pipe and other material was cleaned up and hauled away, which under hand-loading methods would have taken all day.

A typical day finds the machine digging about three overflows or roughly 80 lineal feet of trench. These trenches are dug to depths ranging from 3½ to 5 feet, and are usually two feet wide.

The rush season for our use of the machine lasts from six to seven months, beginning in mid-spring and ending in late fall. During this season in the past two years we not only made almost daily use of the city H-2 but also rented a second rig of this type from a private owner for a period of five or six months. On a few occasions, when the rush was at its height, we also rented a third machine.

Before the city machine was purchased, we handled the digging of catch-basin trenches and storm-inlet overflows exclusively by means of hand labor and pneumatic tools. The dirt was loaded by hand to trailers which were lined up beside the job and later pulled away by a tractor truck.

The crane method of handling the work is much faster and requires a much smaller number of men. The crane operator does the digging alone, loading directly to a hauling truck.

Savings Are Significant

Most significant, of course, are the savings achieved with our present method of handling these excavating jobs. The extent of these savings is indicated by cost analysis of several recent nearly-alike operations, comparing the new and old methods of handling.

In one analysis, the typical hand-labor job involved the digging of a trench for installation of 93 feet of eight-inch storm-inlet drain in an unimproved street. Equipment used involved pneumatic hand-digging tools, trailers, and trailer pulls. The combined labor and Municipal Equipment cost amounted to $4.54 per foot of drain. This was compared with a similar job on which the ¼-yard hydraulic crane and a 5-ton hauling truck was used on the digging. In excavating for installation of 353 feet of eight-inch storm-inlet drain, the crane method per-foot cost was $3.06, or a saving of approximately 33 per cent over hand labor. In making this comparison, material costs were ignored because they remain constant regardless of the method of installation.

Another comparison of two jobs nearly equal in character revealed a per-foot cost of $5.64 for the hand-labor method of digging a trench for 234 feet of overflow. The cost for the crane job, which involved digging 482 feet of trench under similar conditions, was only $4.06 per foot. The individual overflows in each case averaged 34 feet. The savings achieved amounted to 28 per cent.

Useful On Many Jobs

Our best results with the crane are obtained on jobs located on the outskirts of the city rather than in the downtown areas. The reasons are simple. The outlying areas, being relatively free from above-ground obstructions, permit greater freedom of operation, and this is important even with so highly-maneuverable a machine as this. In the outskirts, also, fewer underground structures are encountered. Finally, the hauling distances are much shorter because suitable dumping grounds are almost

always available in the immediate vicinity.

We recently installed some 50 lineal feet of cast iron sewer pipe under the tracks of the C.M.St.P. & P.R.R. on South 72nd Street. This was an emergency job and had to be done within a limited time on a Saturday so as to cause the least interference with train movements and switching operations. We kept the "Hydrocrane" on the job all day and used it for a variety of purposes. We used it for excavating and loading the dirt into trailers. We also used it for handling the pipe and for backfilling around the pipe with crushed stone. All in all this crane proved to be a big timesaver as well as a money saver on this job.

In another instance last fall, we were called upon to dig several blocks of shallow ditch in the vicinity of North 42nd Street and West Lancaster Avenue. Part of the job was suitable for the use of a blade machine and so we rented one from our Bureau of Municipal Equipment. This portion of the ditch was quickly finished and the dirt bladed up into piles, after which it was loaded into a truck with the "Hydrocrane." Another section could only be dug by hand and again the dirt was loaded by means of this same machine. The third and last section of the ditch was somewhat deeper than the rest and this section was excavated and loaded directly into trucks with the "Hydrocrane." Some hand trimming was necessary on this section which was done immediately following the excavating and the dirt thrown ahead so it could be loaded with the machine.

Bureau of Municipal Equipment

While our department has first call on the truck crane and uses it more than any other city department, this machine, like all other city automotive equipment, is owned by the Bureau of Municipal Equipment. We rent the machine on a daily basis, the charge being determined by cost records. The current rental, covering both the machine and an operator, amounts to $33.92 per day, or $4.24 per hour. Privately owned machines are rented for $50.00 per day, but are on the job for a full eight hours, whereas the city machine loses about an hour each day in going to and from the city garage.

In addition to this crane unit, the Bureau of Municipal Equipment, which is headed by Supt. Harry Stiedemann, owns some 1600 pieces of equipment ranging from small pumps to a 5-ton crane.

Truck Crane Being Used For Placing Sewer Pipe
(Hydraulic operation provides exceptionally accurate lowering control)

While the H-2 was purchased primarily for use on Bureau of Sewers jobs, it is also rented to other departments when it is available and needed. The water department ranks next to us in making use of the machine. They use it primarily for handling valves and fittings. I'm told they find it especially useful on the work of their pipe connecting crews. The machine's ability to do precision lowering of the pipe fittings is especially valuable to them because this feature makes it easy to exercise the great care which is necessary.

In addition to our experience with the city machine, we have had frequent opportunities to watch the work of contractor-owned "Hydrocranes" on a number of sewer construction jobs. We have noticed that this crane is particularly a favorite for lowering pipe into a ditch. Despite its relatively light weight it has ample capacity to lift and place the pipe sections plus extremely accurate and dependable control. The H-2 has a capacity of two tons at a radius of eight feet which is ample for handling four-foot sections of 48-in. concrete pipe weighing approximately 3600 pounds. Consequently, it provides a means of handling the work without necessitating the tying up of a large, expensive machine.

Other common operations on these contracts are cleaning up around construction work, backfilling around small structures not easily accessible to bulldozers, pulling sheeting after sewers are laid (where such sheeting is not anchored in a concrete cradle), digging manholes, and other digging and loading "odd jobs."

All in all, we're well pleased with the work demonstrated by "Hydrocranes" on Bureau of Sewers jobs. Without intending a play on words, we're pretty well agreed that this machine is "right up our alley".

New Providence Ordinance Specifies Root-Proof House Connections to Sewers

The New Providence Borough Council (R.I.) recently passed an amended sewer ordinance calling for a change in its regulations regarding house service connections.

This new ordinance provides that house service connections shall consist of root-proof sewers. The main change in the ordinance calls for the use of "Transite" pipe or its equivalent as well as cast iron for housing connections.

CHECKING SEWER VELOCITY

by

T. C. WILLIAMS*

THE CITY of Honolulu has an industrial waste problem in the high acidity and B.O.D. of the wastes from the pineapple canneries. At the time these wastes leave the various plants they have a pH of approximately 4.0 and a B.O.D. of 4000-5000 parts per million. Over a period of 15 years the high acidity of this sewage and the gases formed have caused deterioration of both cast-iron force mains and concrete tunnels.

In an attempt to alleviate this situation until such time as a separate sewer for pineapple wastes could be constructed, it was recommended that the canneries add lime to their wastes in sufficient quantities to maintain the combined sewage at pH 7.0 or above for the length of time required for the sewage to pass through sewer and outfall. As was to be expected, the question arose regarding the length of time required for the complete passage of the wastes through the sewer system.

The length of time was computed, based on n=015 and estimated quantities flowing at various points in the system. However, there were many items which could not be determined with any appreciable exactitude such as: the estimated "n" values, time through the pumping station, rate of flow in sewer as it changes from manhole to manhole, fluctuations in flow due to operation of pumping stations on tributary lines, etc.

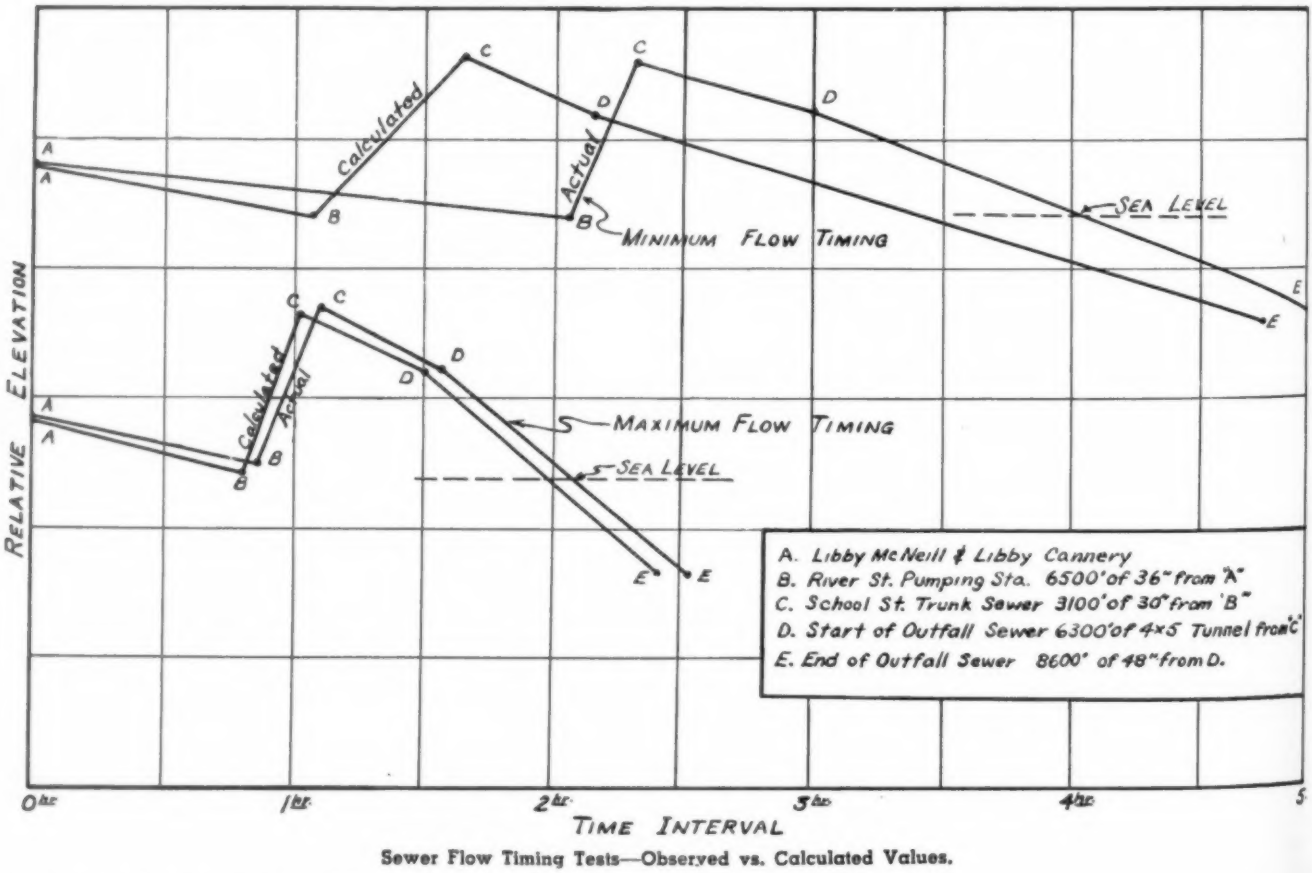
Consequently, it was decided to use a red coal-tar food dye known as Ameranth to check the velocity between several points on the sewers.

By adding small amounts of diluted dye to a liter of sewage, it was determined that the concentration required for sufficient coloration of this sewage was 2 ppm. It was also observed that when the sewage was strongly alkaline the color was less intense; hence, approximately 2 ml. of diluted hydrochloric acid were added to each sewage sample as taken during the tests.

Two flow-timing tests were run—one at 12 noon and the other at 1:00 A.M. In a sewer flowing at the rate of 6 mgd., three pounds of Ameranth were used. The resulting color was similar to that of strawberry soda pop. By taking a control before the color came to the sampling point and then taking samples at regular intervals during the flow of dye past the sampling point and placing these acidified samples in quart jars, it was easy to ascertain the time of maximum dye concentration at the several points along the way. When the dyed sewage left the outfall, a circle of red about 400 ft. in diameter was observed on the ocean surface. From an airplane several patches of red were also observed along the subaqueous portion of the sewer, showing locations of breaks in the line.

It was found that while there was a discrepancy between the actual and the calculated times for each section of the line, the total time was almost an exact check (see diagram). It was obvious that for minimum flows the time from "A" to "B" was increased due to a head on the sewer coming into the wetwell at "B," as the pump operates infrequently during the low flow. Therefore it would appear that the quantity flowing in the 48 in. pressure line was larger than estimated.

*Williams & Works, Engr's., Grand Rapids, Mich.


RELATIVE ELEVATION
Calculated
Actual
MINIMUM FLOW TIMING
MAXIMUM FLOW TIMING
SEA LEVEL
A. Libby McNeill & Libby Cannery
B. River St. Pumping Sta. 6500' of 36" from 'A"
C. School St. Trunk Sewer 3100' of 30" from 'B"
D. Start of Outfall Sewer 6300' of 4x5 Tunnel from 'C"
E. End of Outfall Sewer 8600' of 48" from D.
0 hr
1 hr
2 hr
3 hr
4 hr
TIME INTERVAL

Sewer Flow Timing Tests—Observed vs. Calculated Values.

This method of timing flow through sewers provides a simple procedure for determining the condition of sewers too small for a man to enter. The velocity having been found, the depth of flow may be measured and the hydraulic radius (R) determined. Then by substituting in Manning's formula

$$V = \frac{1.486}{n} R^{2/3} S^{1/2}$$

and solving for "n," a comparison may be made between this actual value and the theoretical value for the specific type and age of sewer involved.

CHLORINE INSTITUTE CELEBRATES 25TH ANNIVERSARY

Elects R. W. Hooker, Pres.; Honors S. W. Jacobs, Retiring; H. A. Faber Announced as A.W.W.A.'s Diven Medalist

CELEBRATING its 25th anniversary, The Chlorine Institute, Inc., held a record size dinner meeting in the Hotel Biltmore, New York City, at which Henry J. Taylor, renowned radio commentator, reporter, author and economist, was the principal speaker. Mr. Taylor revealed some of the "behind the scenes" relations of government and business and underlying facts in America's current dealings with foreign powers, and gave a preview of disclosures and corrective recommendations by the Hoover Committee as an outgrowth of its studies of Federal government operations and taxation and spending as they exist today.

President Jacobs' Retiring Address

In his retiring speech as president of The Chlorine Institute for twenty of its twenty-five years of existence, S. Willard Jacobs, Vice President of Niagara Alkali Co. and Electro-Bleaching Gas Co., presented an interesting review of progress in chlorine production and distribution during the life of the Institute, which was organized in April 1924, with ten firms represented at the organizational meeting. He emphasized the growth in tonnage of chlorine production during the period as having mounted from 225,000 tons per year in 1924 to eight times that amount in 1949—namely, 1,800,000 tons per year. Significant was the fact that chlorine, once a waste by-product in caustic soda production, has come to be as basic in industry as either sulphuric acid or caustic soda. He also emphasized the progressive lowering of chlorine prices over the 25 years, through increased production in conjunction with the shipment of liquid chlorine in the one ton container, multiple unit tank car, even larger single unit tank cars, and now special 600-ton capacity water-carriage barges.

The Institute, said President Jacobs, can look with a deal of pride on its accomplishments in the direction of advancing safety in the packaging, shipment and handling of chlorine since 1926. In this category the standardization of cylinder, ton-container and tank car valves and safety fusible plugs in the chlorine industry constituted an outstanding accomplishment of the Institute, which had not been paralleled in any other branch of the huge compressed gas industry of America. This all-important development was the outgrowth of a desire of the industry to provide standardization and interchangeable equipment for use in the water and sewage treatment and sanitation fields in order to preclude possible chlorination failures due to non-interchangeable cylinder connections and non-uniform valve design and operation. The most recent contribution to safety in chlorine handling and use had been the Institute's "Chlorine Manual", representing the consolidation of the best thoughts and knowledge of the entire chlorine industry. (Context of the "Chlorine Manual" is to be found in the 1947 Reference and Data Number of *Water & Sewage Works*, July, 1947, and copies are available from The Chlorine Institute, Inc., 50 East 44th St., New York, N.Y.—Ed.)

R. W. Hooker, Successor, Presents Memento

At the completion of his retiring address, Mr. Jacobs was the recipient of a handsome antique English silver coffee tray, appropriately engraved as a token of appreciation of his 20 years of guidance of the Institute and a show of affection by the members. The presentation was made by Institute Vice-President R. W. Hooker, Vice-President of the Hooker Electro-chemical Co., who later was elected to succeed Mr. Jacobs as president of the Institute.

Linn H. Enslow, who 24 years ago became associated with the Institute as Research Engineer one year after its organization, was introduced by Mr. Jacobs as President of the American Water Works Association. Mr. Enslow expressed his pleasure in working for the Institute and used the opportunity to announce the signal honor paid to Harry A. Faber, Research Chemist of the Institute, by the American Water Works Association Board of Directors, which had just two days previously voted Mr. Faber the John M. Diven Memorial Medal "in recognition of his effective services to the Association, and for his contributions toward a better understanding of water and sewage chlorination and the safe handling of chlorine."

New Officers

At the close of the 25th Anniversary Meeting the Institute Directors met and elected the following as officers.

R. W. Hooker, President
W. I. Galliher, Vice-President
R. T. Baldwin, Secy.-Treas.

(Mr. Baldwin has served the Institute as Secretary-Treasurer during its full 25 years.)

The following constitutes the Board of Directors of the Institute for the year 1949.

G. M. Dunning, Michigan Chemicals Corp.
F. W. Fraley, Diamond Alkali Co.
W. I. Galliher, Columbia Chemical Div.
R. W. Hooker, Hooker Electro-Chemical Co.
E. W. Haley, Southern Alkali Corp.
S. C. Harris, E. I. DuPont de Nemours Co.
S. W. Jacobs, Niagara Alkali Co.
L. Neuberg, Westvaco Chemical Div.
R. S. Roeller, Pa. Salt Mfg. Co.
E. E. Routh, Mathieson Chemical Corp.
W. H. Sheffield, Innis, Speiden & Co.
H. W. Umphrey, Canadian Industries Ltd.

SEPTIC TANK PERFORMANCE UNDER SURGE FLOW CONDITIONS

by
HARVEY F. LUDWIG
Ludwig Bros., Cons. Engrs.
PASADENA, CALIF.

THIS paper reports a summary of test data obtained over the 2-month period, Oct. 1 to Nov. 30, 1948, for the Nottingham septic tank testing program which is in progress at Monrovia, Calif.

The testing program was begun in April, 1948, and during the period of June to Sept. 1948, inclusive, tests were conducted under uniform flow conditions. Results of those studies were published in *Water & Sewage Works*, page 460, Dec. 1948. The present test data were obtained under surge flow conditions.

The raw sewage was applied to the two septic tanks under test in a group of six equal batches at 2-hour intervals over the 12-hour test day. Each batch application was equal in volume to 1/6 the total capacity of the septic tank under test, so that the entire tank contents were displaced each test day. Each batch was applied by gravity flow from storage reservoirs over a 10-minute period, although most of the batch was emptied from the storage tank in the first 7 minutes of this 10-minute period. The storage reservoirs for both septic tanks were filled for each test with the same sewage, which was fresh sewage drawn as needed from the City of Monrovia outfall.

As in the previous testing program, comparable data were obtained for a battery tank of 5,250 gal. capacity formed from seven Nottingham C-14 units connected in series and for a "standard" rectangular tank of 800 gal. capacity. The test procedure was followed six days weekly over the 2-months' period, for a total of 52 days, but sewage composite samples were collected and analyzed only 30 days (approximately 4 days each). The sludge present in the two septic tanks at the beginning of the test period was that accumulated during the previously reported period, i.e., the period of uniform flow conditions. This sludge was observed to be only 2 to 6 inches deep and to be a mass of loosely consolidated fine black particles. The data are reported in Tables I and II.

Table I
SUSPENDED SOLIDS REMOVALS
SUMMARY OF TEST RESULTS FOR SURGE FLOW CONDITIONS,

Date	Influent ppm.	Battery Installation Effluent, ppm.	% Removal	Rectangular Tank Effluent, ppm.	% Removal
10/5	274	28	90	74	73
10/6	232	12	95	23	90
10/7	200	10	95	38	81
10/11	291	20	93	41	86
10/12	257	15	94	37	86
10/13	147	8	95	34	77
10/14	228	19	92	18	92
10/18	381	31	92	82	78
10/19	316	26	92	46	85
10/20	238	11	95	11	95
10/21	168	6	96	27	84
10/25	263	4	98	23	91
10/26	297	12	96	72	76
10/27	308	17	94	49	84
10/28	650	5	99	12	98
11/1	399	13	97	52	87
11/2	252	11	96	33	87
11/3	225	14	94	28	88
11/4	219	13	94	40	82
11/8	390	23	94	49	87
11/9	300	24	92	44	85
11/10	536	12	98	44	92
11/15	335	49	85	80	76
11/16	350	59	83	86	75
11/22	303	16	95	105	65
11/23	372	45	88	114	70
11/24	374	22	94	67	82
11/25	393	20	95	33	92
11/29	996	12	99	90	91
11/30	294	14	95	32	89
Average	333	19.0	93.8	49.5	84.1

Table II
SETTLEABLE SOLIDS REMOVALS
SUMMARY OF TEST RESULTS FOR SURGE FLOW CONDITIONS

Date	Influent ml./L.	Battery Installation Effluent, ml./L.	% Removal	Rectangular Tank Effluent, ml./L.	% Removal
10/5	12.	0.1	99	1.4	88
10/6	14.5	1.0	93	1.6	89
10/7	10.2	0.2	98	0.5	95
10/11	12.	0.15	98	0.45	95
10/12	10.	0.15	98	0.35	96
10/13	7.6	0.1	99	0.3	96
10/14	10.4	0.1	99	0.1	99
10/18	19.1	0.1	99½	0.2	99
10/19	11.9	0.05	99	0.15	99
10/20	11.0	0.7	94	0.6	95
10/21	8.4	0.15	98	0.3	96
10/25	12.0	0.05	99	0.5	96
10/26	9.3	0.1	99	1.4	85
10/27	9.0	0.05	99	0.25	97
10/28	24.	0.05	99½	0.1	99
11/1	12.7	0.1	99	2.4	81
11/2	11.0	0.05	99	0.4	96
11/3	7.6	0.15	98	0.2	97
11/4	10.6	0.05	99	0.15	99
11/8	19.	0.25	99	0.5	97
11/9	9.4	0.1	99	0.2	98
11/10	33.	0.1	99½	1.1	97
11/15	11.8	0.2	98	0.6	95
11/16	20.	0.1	99½	0.8	96
11/22	11.1	0.15	99	0.4	96
11/23	12.5	0.2	98	1.6	87
11/24	13.9	0.05	99	1.6	88
11/25	14.1	0.1	99	0.2	99
11/29	31.7	0.1	99½	2.5	92
11/30	14.7	0.05	99½	1.0	93
Average	13.8	0.16	98.5	0.73	94.5

The results of these comparative tests show a marked superiority in performance by the battery tank. The battery tank removed, on the average, 93.8 per cent of suspended solids and 98.5 per cent of settleable solids as compared with only 84.1 and 94.5 per cent respectively for the "standard" tank.

Another criterion of performance, not listed in the tables, was the color of the effluent. Whereas the effluent of the "standard" tank was invariably slightly black in color due to suspended particles derived from the bottom sludge, the effluent from the battery tank had this slightly black color on only two out of thirty occasions. Also, it was noted that whereas both septic tanks were charged over an identical 10-minute period, the periods of overflow at the tank outlets were greatly different, namely 20 min. for the "standard" tank and 50 min. for the battery tank. At no time during overflows were the outlet pipes flowing more than half full.

AN OMINOUS DROUGHT

by

HALBERT P. GILLETTE*
SAN MARINO, CALIF.

THE *New York Times* recently quoted Jerome Namias of the U.S. Weather Bureau as saying: "We can't put much stock in weather cycles. We can't prove their existence today and maybe we'll never be able to." Coming from the chief of the Bureau's extended forecast section, this is an amazing statement, for many cycle researchers have independently established the existence of numerous cycles. The inability hitherto to use cycles successfully for forecasting weather from season to season, or week to week, has been due partly to the large number of cycles and partly to their different effects in different regions. Furthermore, until recently the lengths and dates of many cycles had not been accurately determined.

Although the number of short cycles is great, there are relatively few long ones. By long cycles I mean those whose intervals between maximum effects are 200 years or more. Those are the cycles that have the greatest amplitudes, or maximum departures from a mean, and also cause the most prolonged warm-dry and the most prolonged cold-wet epochs. The Glaciation (Ice Age) Cycle exemplifies an extreme both of amplitude and duration of a cycle whose length (interval between maxima) is of the order of 150,000 years, and whose last maximum or peak was about 20,000 years ago.

The Author

Triplex Series Dominant

I have found that the longest cycles have lengths each of which is three times that of the next shorter one, and that they are harmonic; that is to say, the maxima of the shorter cycles are coincident with maxima of longer cycles in this dominant triplex series of climatic cycles.

To find this important series of cycles it was necessary to study geological records and formations. The accompanying photograph pictures a few of 32 pairs of white and black beds of rock, that have been tilted from their original horizontal position. In these beds are thin laminae, called varves, that were deposited annually. The beds resemble tree-rings in that they are found to be thicker when rainfall and runoff were heavier. Short weather cycles of the same lengths as those in tree-rings have been found in rock varves, as well as in mud varves in existing and ancient lake beds. Thus we know that they are annually deposited layers.

Each pair of white and black beds records a climatic cycle. Since the average thickness of these 32 pairs is 4.5 feet, and since the average thickness of the varves is 11 to the inch, the climatic cycle here recorded has a length of about 600 years from extreme warmth to extreme warmth. The white beds are calcareous, that is they contain calcium carbonate which in its pure form appears as crystals of calcite in limestone and marble. All soil contains calcium carbonate, some of which is leached out by rainwater, for calcium carbonate is soluble in water containing carbon dioxide. This carbonic acid gas exists in the air and is dissolved by rain, thus producing a weak acid which, in the course of ages, has cut great caverns in limestone in many regions.

Delivered to the sea by streams the weakly carbonated water floats on the denser seawater, and is thus exposed to the sun's rays which drive out some of the carbon dioxide and cause precipitation of calcium carbonate. That is why a rock varve often has a very thin white lamina that records the summer phase of the annual cycle. On a grander scale, when there was long recurrence of warmer years with intensely hot summers, thick beds of calcium carbonate were precipitated. In some cases it was mixed with mud to which it imparts a whitish color. In extreme cases, when the streams were low and carried little silt, pure limestone resulted. It is important to understand how these paired white and black beds were formed, for thus we know that we are looking at the effects of a dominant climatic cycle when we see such a series of beds as those shown in the accompanying picture. (The reader may be interested in consulting U.S. Geological Survey, Professional Paper 158, by W. H. Bradley, published in 1929.)

Having thus found a climatic cycle of about 600 years, I noticed that every third pair of beds often had thicker white beds, indicating a cycle of about 1800 years. I found also that,

Geological Formations Reveal the Important Dominant Triplex Series of Weather Cycles

*President, Gillette Publishing Co.

about 14 or 15 feet apart, beds of sandstone often occur, evidently recording the wet phase of the 1800-year cycle; and that every third bed was thicker, thus recording a cycle of 5400 years.

In a forthcoming booklet on "Cycles" being produced by the writer evidence of these and longer triplex series of cycles, as well as those shorter than 200 years, will be presented. Evidence as to the dates of their maxima and minima ("peaks" and "valleys") will be given. A copy of this booklet on "Cycles" will be sent on request. For the present it will suffice to indicate one way of dating the peak and valley of the 1800-year cycle, hence the 600-year and 200-year cycles also.

European glaciers made their greatest recorded advance about the close of the 17th century. The Thames at London froze solid enough to support horses in 1684 and 1685, an event without subsequent parallel. About 900 years earlier, as the Nileometer records at Cairo show, the annual maxima (floods) and annual minima (droughts) were less for years than they had been before or since. Those records are known back to A.D. 622, and have no break till 1470. They also show the 200-year cycle very well. Del Valle called it 210.

By means of Lake Saki varves and tree-rings, I have found rainfall cycles of exactly 22⅓, 67 and 201 years, and also evidence of longer cycles in this triplex series. These shorter cycles indicate a peak of the 603 and 1809-year cycles in 1682; hence the next valley (maximum dryness and warmth) will be in 1984 as set forth in my article in the December, 1941, issue of *Water Works and Sewerage*.

What Glaciers Reveal

There is abundant evidence of a world-wide trend toward increasing warmth and decreasing rainfall that has been going on for a century or longer. Gagings of the Columbia River began in 1879, and show this trend. Much more striking is the increasing rate of shrinkage of the Nisqually Glacier on Mt. Rainier, Washington, about 50 miles from Puget Sound. Its evidence is more outstanding because a glacier shrinks both because of decreased snowfall and because of increased warmth, which go together in the case of long climatic cycles. The location of the front of this glacier in 1857 was quite well established by men who explored it then. The following are its rates of retreat in feet per annum from 1857 to the present.

RETREAT OF THE NISQUALLY GLACIER

Period	Ft./Yr.
1857-1885	26
1885-1892	20
1892-1918	50
1918-1928	70
1928-1938	73
1938-1948	81

Since 1918 surveys have been made annually in September. In my forthcoming booklet the retreat each year for 30 years will be given. The greatest retreat was 154 feet in 1934. The retreat in 1948 was 88 feet.

Mono Lake in California, on the east side of the Sierra Nevada Mountain range is land-locked and fed mainly by melting snows and ice in nearby glaciers. In consequence its level has tended to rise during warm periods. Thus between 1857 and 1919 it rose 50 feet, during which period nearby tree-rings were abnormally thin for most of these years. In 1914 a tree having 150 rings was actually drowned by the rising lake, thus showing that the temperature of the air had been increasing since before 1760. Historical evidence shows that these glaciers have been shrinking since 1850, and the smaller ones have ceased to exist. There have been halts in their retreats, due to the effects of shorter cycles of phase opposed at times to the great 603-year cycle.

The 67-year cycle has great amplitude for a relatively short climatic cycle, and the next cold-wet peak of this cycle is due in 1950, yet apparently it has not reduced the rate of retreat of the Nisqually Glacier. In the next five years two other strong cycles, one of about 63 and one of about 77 years, will have cold-wet peaks, which may assist the 67-year cycle in reducing the rate of retreat of the glacier.

The 201-year cycle and subcycles had a peak in 1883, which reduced the retreat rate of the glacier as shown in the foregoing table. The next few years probably will be abnormally cold and wet in many regions, but thereafter the trend toward warmth and dryness will resume.

SPECIAL TRAINING COURSE IN WASTE DISPOSAL

Univ. of Michigan School of Public Health Holds Course March 14-15.

The Univ. of Michigan School of Public Health is offering the first in-service training course in selected technical problems in sewage and industrial waste disposal on March 14 and 15 at the School of Public Health Bldg., 109 S. Observatory St., Ann Arbor, Mich.

The course was planned with the advice and assistance of the following committee: Jack E. Cooper of the Ford Motor Co.; Austin Habermehl, Detroit Sewage Treatment Plant; Harry E. Miller, School of Public Health, Univ. of Michigan; Loring F. Oeming, Stream Control Commission of Michigan; Donald M. Pierce, Michigan Dept. of Health; and Henry F. Vaughan, Dean of the School of Public Health.

This course, the first to be given in sewage and industrial waste disposal problems, is the 31st inservice training course to be held by the School of Public Health.

Presiding the first day will be John M. Hepler, Director, Bureau of Engineering, State Board of Health, Lansing, Mich., and on the second day, Thomas J. Powers, Project Engineer, Waste Disposal Div., Dow Chemical Co., Midland, Mich.

Instruction will be conducted by a special faculty group brought together for this occasion. This faculty group will include L. L. Hedgepeth, Consulting Engineer to American Cyanamid Co., formerly Executive Secretary of the State Water Control Board, Richmond, Va.; H. W. Streeter, Sanitary Engineer, Director (retired) of the U. S. Public Health Service; C. J. Velz, Head of the Civil Engineering Dept., Manhattan College, New York; James B. Lackey, Editor of The Blakiston Co., Philadelphia; W. L. Mallmann, Professor at Michigan State College; Edward W. Moore, Professor at Harvard University; and L. F. Warrick, Chief Engineer of the State Dept. of Health at Madison.

Among the topics to be covered in the school are stream standards, biological indicators in stream pollution, bacteriology of stream sanitation, analytical data in reference to stream sanitation, chlorination of sewage and wastes in reference to stream sanitation.

The course is designed especially for the benefit of scientific workers.

Applications for enrollment in the course should be submitted in writing to the School of Public Health promptly. The enrollment fee is $5.00. A certificate of attendance will be granted.

Accommodations may be obtained at the Michigan Union. In making applications, be sure to state that the accommodation is requested in connection with attendance of this course.

The closing date for enrollment is March 7.

YOU CAN'T CUT WITH HALF A SCISSOR

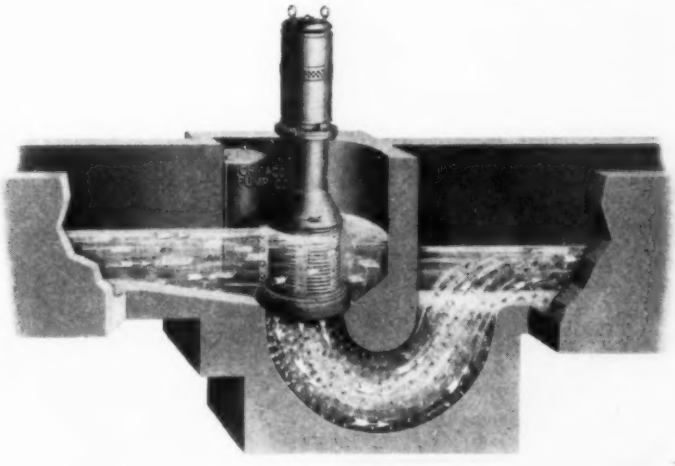
The 25A COMMINUTOR. This machine will handle flows averaging up to 10,000,000 gallons a day when set in a channel of proper design. The scissors point to the shear bars and cutting teeth on the slotted drum.

When you specify the CHICAGO COMMINUTOR you get both halves of the scissors.

The channel acts as the holding and feeding half of the scissors. The cutting teeth and shear bars of the COMMINUTOR drum make up the cutting half of the pair.

Years of research and knowledge gained through more than 2,000 successful installations prove conclusively that the hydraulic characteristics of the channel in which the COMMINUTOR is placed are as important as the cutting mechanism itself.

The form of the channel which makes effective comminution possible is an exclusive feature of the CHICAGO COMMINUTOR. Clogging and binding of coarse solids in CHICAGO COMMINUTORS is positively eliminated.

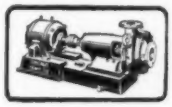


Cross section view of a typical channel design for the CHICAGO COMMINUTOR. Detailed drawings of acceptable channel forms are available to qualified engineers. For further information on COMMINUTORS, sizes, capacities and channel design write for Bulletin 185.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2300 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**



Flush Kleen, Scru-Peller, Plunger. Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers, Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

Setting A New High
IN QUALITY AND VALUE

TODAY'S Layne Well Water Systems and Vertical Turbine Pumps set an amazingly new high in long lasting quality and big dollar value. Years and years of constant improvements in design has given them unmatched overall efficiency. And along with high efficiency there have been many improvements in quality. All strain points have been made heavier and stronger. All bearing surfaces are now tougher and longer lasting. Controlled precision in manufacture has added more smoothness to operation.

All in all, your Layne Well Water Systems and Vertical Turbine Pumps of today produce more water at lower operation cost than ever before. Dependability in construction features is not limited to a season or two. They are there to provide service for years and years with little or no upkeep expense.

But you will also be interested to know that if service of any nature is ever required, the Nation-wide Layne organization has the facilities and know-how to put your system back in perfect order with a minimum loss of time.

For further information about Layne Well Water Systems and Layne Vertical Turbine Pumps, write for catalogs, and bulletins. No obligation. Address LAYNE & BOWLER, INC., General Offices, Memphis 8, Tenn.

LAYNE
WELL WATER SYSTEMS

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis Tenn. * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisian Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee, Wis. * Layne-Ohio Co., Columbus, Ohio * Layne-Pacific, Inc., Seattle, Washington * Layne-Texas Co., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Minnesota Co., Minneapolis, Minnesota * International Water Corporation, Pittsburgh, Pa. * International Water Supply, Ltd., London, Ontario, Canada * Layne-Hispano Americana, S. A., Mexico, D. F.

MEETINGS SCHEDULED

MAR. 15-16—ANN ARBOR, MICH. (School of Public Health)
In-Service Training Course of Michigan Sewage Works Assn. Director, Harry Miller, School of Public Health, University of Michigan, Ann Arbor, Mich.

MAR. 17—BOSTON, MASS. (Statler Hotel)
New England Water Works Association. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston 8, Mass.

MAR. 23-25—TRENTON, N.J. (Hotel Stacy-Trent)
New Jersey Sewage Works Association. Sec'y-Treas., M. S. Kachorsky, P. O. Box 283, Manville, N.J.

MAR. 31-APRIL 1—NATURAL BRIDGE, VA. (Natural Bridge Hotel)
Virginia Industrial Wastes & Virginia Sewage Works Association. Sec'y, A. H. Paessler, 815 E. Franklin St., Richmond 19, Va.

APR. 1-3—PRESCOTT, ARIZONA (Hassayampa Hotel)
Arizona Section A.W.W.A. Sec'y, Mrs. Helen Rotthaus, State Department of Health, Phoenix, Ariz.

APR. 8-9—GREAT FALLS, MONTANA (Johnson Hotel)
Montana Section A.W.W.A. Sec'y-Treas., C. W. Brinck, State Board of Health, Helena, Mont.

APRIL 11-13—LITTLE ROCK, ARKANSAS
Arkansas Water & Sewage Conference. Sec'y, Dr. Harrison Hale, Univ. of Arkansas, Fayetteville, Ark.

APR. 20-22—INDIANAPOLIS, IND. (Lincoln Hotel)
Indiana Section A.W.W.A. Sec'y-Treas., C. H. Bechert, Indiana Dept. of Conservation, State Library Bldg., Indianapolis, Ind.

APR. 21-22—HUTCHINSON, KANSAS (Bisonti Hotel)
Kansas Section A.W.W.A. Sec'y-Treas., M. C. Hagar, Supt. Water Department, City Hall, Lawrence, Kansas.
(and)
Kansas Section, Federation Sewage Works Assn. Sec'y, Dwight F. Metzler, Room 2, Marvis Hall, Lawrence, Kansas.

APR. 21-22—LINCOLN, NEB. (Cornhusker Hotel)
Nebraska Section A.W.W.A. Sec'y, John W. Cramer, 922 Trust Bldg., Lincoln 8, Neb.

APRIL 24-27—QUEBEC CITY, QUEBEC, CANADA (Chateau Frontenac)
Canadian Section A.W.W.A. Sec'y, Dr. A. E. Berry, Ontario Department of Health, Parliament Bldgs., Toronto, Ontario, Can.

APRIL 28-29—ELMIRA, N. Y. (Mark Twain Hotel)
New York Section A.W.W.A. Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York, N.Y.

APR. 28-29—HAGERSTOWN, MD. (Alexander Hotel)
Maryland-Delaware Water & Sewerage Association. Sec'y-Treas., E. Virginia Gipe, 2411 N. Charles St., Baltimore, Md.

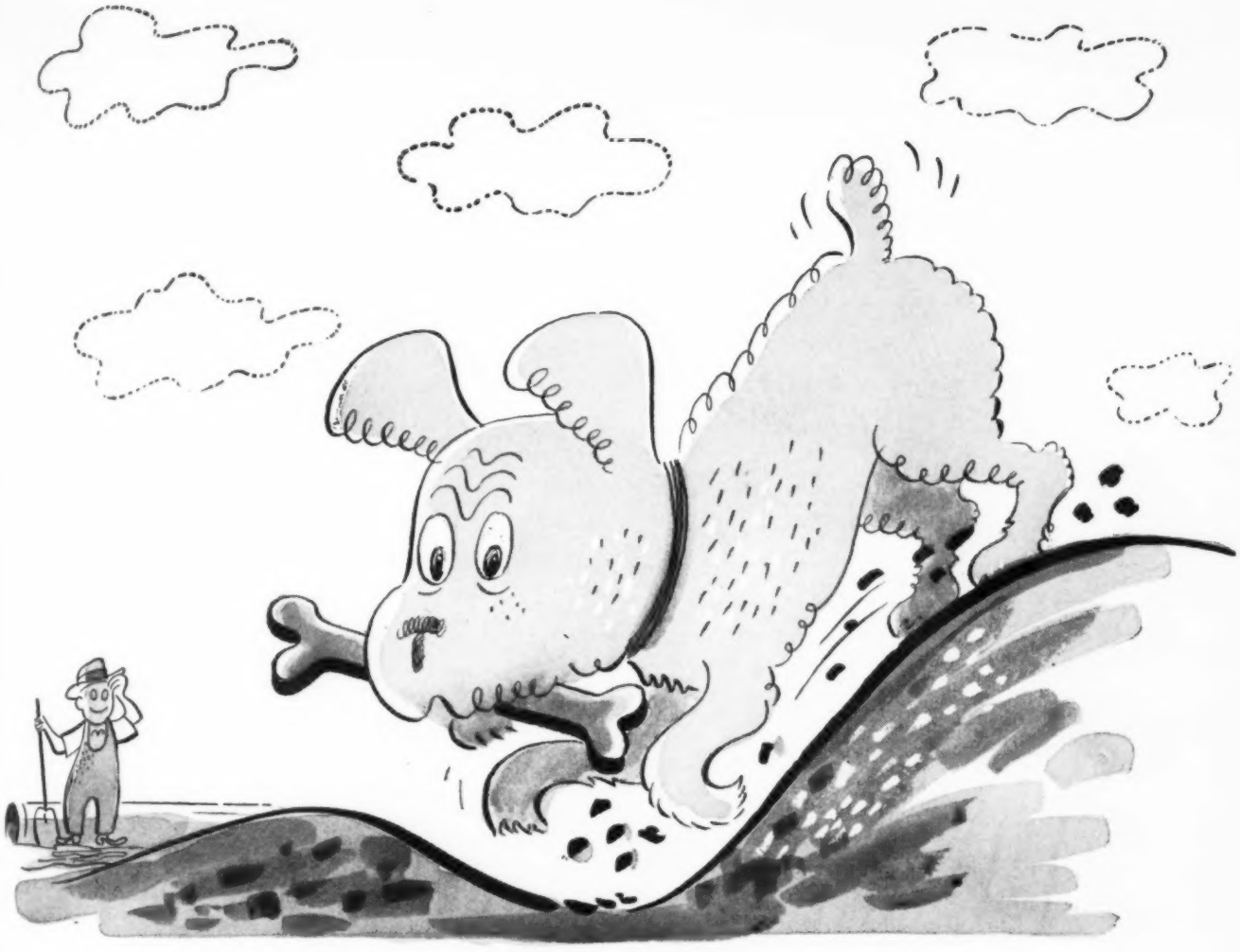
APR. 29-30—BAKERSFIELD, CALIF. (Hotel not selected)
California Section A.W.W.A. Sec'y, H. C. Medbery, San Francisco Water Department, Millbrae, Calif.

MAY 12-14—BELLINGHAM, WASH. (Bellingham Hotel)
Pacific-Northwest Section A.W.W.A. Sec'y-Treas., Prof. Fred Merryfield, Oregon State College, Corvallis, Ore.

MAY 25—BRISTOL, CONN.
New England Sewage Works Association. Sec'y, Walter E. Merrill, State Dept. of Health, State House, Boston, Mass.

MAY 30-JUNE 3, 1949—CHICAGO, ILL. (Stevens Hotel)
American Water Works Association Annual Conference. Exec.-Sec'y, Harry E. Jordan, 500 Fifth Avenue, New York 18, N.Y. (All reservations will be cleared through the A.W.W.A. office. Reservation forms will be mailed to members after November 1.)

JUNE 23—WANAQUE, N. J.
New Jersey Section A.W.W.A. (Outing and Inspection) Sec'y, C. B. Tygert, P. O. Box 178, Newark, N.J.



Lower Excavation Costs

Substantial savings in excavation costs are often possible with Transite* Sewer Pipe because of its high flow capacity. This often permits the use of flatter grades and shallower trenches. This is a particularly important advantage where the pipe must be laid at or below the ground water line or where rock excavation is involved.

As an alternate economy, designers may take advantage of Transite's high flow capacity by specifying smaller diameter pipe.

Other Transite Economies

Transite's long 13-foot lengths and light weight lower handling costs. And because there are fewer joints to assemble in the finished line, installation is faster, and more economical.

As a further economy, Transite's sleeve-type joints guard effectively against infiltration. This helps reduce the load on the treatment plant. Therefore, treatment costs are kept to a minimum—plant capacity is conserved for the increased loads incident to community growth.

Made of asbestos, cement and silica combined into a homogeneous material of great stability, Transite Sewer Pipe is corrosion-resistant both inside and outside. Tight joints safeguard against root trouble. And every Transite length is factory-tested for strength and uniformity. This adds up to low maintenance costs through the years.

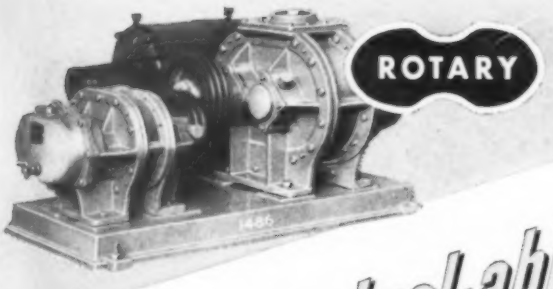
For all the facts about Transite, send for brochure TR-21A. Address Johns-Manville, Box 290, New York 16, N. Y.

JOHNS MANVILLE JM PRODUCTS

*Transite is a Johns-Manville registered trade mark

.....Johns-Manville

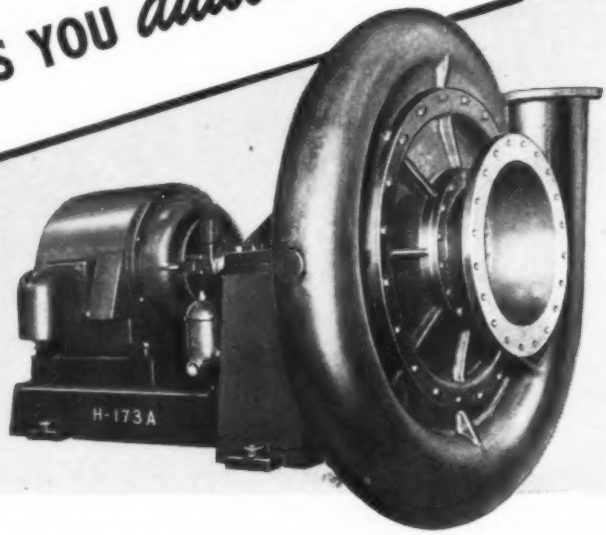
TRANSITE SEWER PIPE...



R-C Blower and Gas Booster mounted on same bedplate, with V-belt drives from 5 HP motor. Capacity, 125 CFM.

ONLY *R-C dual-ability* GIVES YOU *dual choice*

CENTRIFUGAL



R-C Centrifugal Blower —24" type OIB, driven by 250 HP motor. Capacity, 15,220 CFM.

When it comes to choosing between Centrifugal and Rotary Positive Blowers and Exhausters, you'll get impartial suggestions from R-C *dual-ability*. That's because we build both —and we are the only blower manufacturer who gives you the benefit of this *dual choice*.

Another advantage of consulting us results from our wide range of units of both types. If it's 10 CFM you need, we'll supply it. Or, if your use calls for extremely large volume, we build them to any desired size.

One more point—air or gas handling equipment is our "bread and butter" . . . we have no other business. That means detailed and *interested* attention to your requirements from an organization that has specialized on that job for almost a century.

ROOTS-CONNERSVILLE BLOWER CORPORATION
905 Mount Avenue, Connersville, Indiana

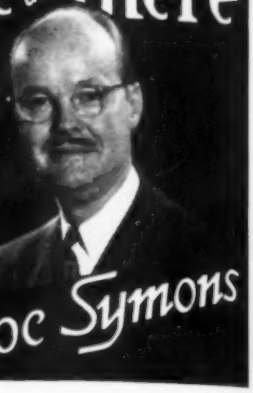
ROOTS-CONNERSVILLE

BLOWER BUILDERS • R-C • SINCE 1854

BLOWERS • EXHAUSTERS • BOOSTERS • LIQUID AND VACUUM PUMPS • METERS • INERT GAS GENERATORS

* * ONE OF THE DRESSER INDUSTRIES * *

Here and There with Doc Symons



H.T.M.A.—And before we get any further into this year, there are several bits of unfinished business from '48. So with your kind permission — — —

* * *

"Norman Slater is a water works superintendent with a sense of humor." So says an article in the *Mueller Record* which tells the story of this 24-year-old ex-G.I. who unexpectedly found himself named superintendent of streets and water at Windsor, N. Y. Norm expresses his sense of humor in cartoons, a number of which were printed in the *Record*.

* * *

I didn't get to the last 4-States Sect. meeting in Philadelphia this past Oct. And now it's the Pennsylvania Section of A.W.W.A. No longer will I journey out to Pittsburgh to attend the Western Penna. Sect., where for ten or more years that peerless Secretary, Earle Johnson, of W & T, kept me wanting to come back for more. Wonder what extra-curricular activity Earle will turn his attention to now? —He's already an accomplished golfer.

* * *

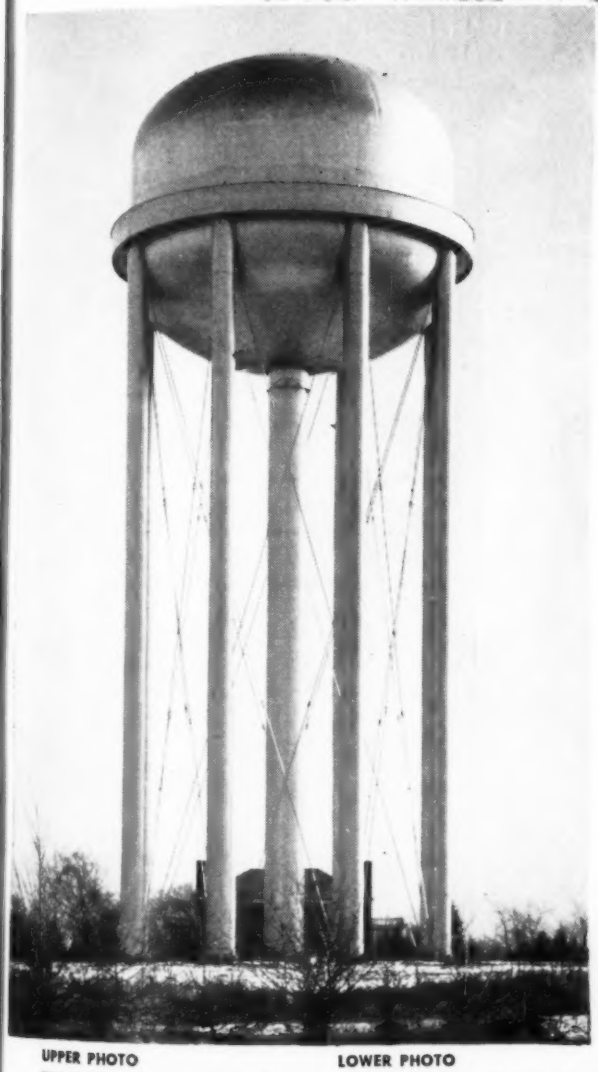
By the way, Tom Camp, Cons. Engr. of Boston, says that R. E. Sweeney, the New England Agent for U.S. Pipe and Fdry., wants to know what was the name of Paul Revere's horse. Help, Help! Some of you delvers into historic lore to the rescue!

* * *

Of several delightful memories of the Virginia Section meeting in Richmond, I recall one quite vividly. I overheard some one of the male registrants at the meeting saying, "I don't know who you are, but you're beautiful." I looked around, of course, and darned if the guy wasn't right, for he was talking to Miriam (Mrs. Stu.)

When APPEARANCE is a factor... joined with sound efficiency and economy in MODERN WATER STORAGE...

Specify



TUBULAR COLUMN TOWER

ELEVATED STEEL TANKS

by **PITTSBURGH •DES MOINES**

Architecturally handsome appearance, complementing the character of high-value districts, is a *plus* advantage of our Tubular Column Tower elevated steel tank design.

Furnished in double-ellipsoidal or toroidal-bottom types, these tanks are available in a wide range of capacities for every community demand—providing better water service at lower cost, with attractive aspect in any locality. *Write for a consultation.*

UPPER PHOTO
This 60 ft. diameter tore-ellipsoidal tank stores 500,000 gallons of water within a 25'0" head range. Height from foundation top to tank bottom is 100'0".

LOWER PHOTO
500,000 gallons of water are stored 92'10" above foundation tops in this 50'0" diameter double-ellipsoidal type tank, having a head range of 39'2".

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH.....3416 Neville Island
NEW YORK.....Room 918, 270 Broadway
CHICAGO.....1222 First National Bank Building
DES MOINES.....919 Tuttle Street
DALLAS.....1223 Praetorian Building
SEATTLE.....926 Lane Street
SANTA CLARA, CAL.....625 Alviso Road

Crawford, of Franklin, Va.—He's a consulting chemist on water and waste problems.

* * *

I was glad to see Alice Melrose, Asst. to the Secy. of N.E.W.W.A., when the meeting was held in New York in Sept. With all due respect to Joe Knox, as Secy., I wondered what he would do without her.

It was at that meeting that, between sessions, I caught "Charlie" Richardson, Vice Pres. of Builders-Providence, indulging in cherry pie and ice cream at the drug counter.

Nice banquet the N.E.W.W.A. had and as usual I renewed some acquaintances: F'instance, Dave and Dottie Gallagher of the Worthington Pump Gallagher's, who had to go home early to take over the baby sitting chores (with their own children, of course); and Bill and Jane Grant of Atlas Mineral Products; and "Bill" and Grace Foster—He works for some magazine.

And when retiring president Don Calderwood of Nashua, N.H., introduced the incoming prexy, he said, "You now have a King for a President; Arthur C., that is." Don also called attention to the fact that Arthur C.'s father had been president of N.E.W.W.A. 38 years before. Don said many other nice things about the new pres. and when Arthur C. (King, that is) took the gavel, he said that now he "knew how a pancake felt when you poured syrup on it."

* * *

Letters to the Columnist Dept.—G. Francis Fynn, who signed his letter **H**ail **T**o **M**y **A**ntecessor (he having taken my place in Buffalo when I came to New York) called attention to an error in my October Column wherein I said that 48 out of every hundred subscribers to this magazine read my column regularly, 29 skim it regularly, 24 more read it occasionally and 9 don't read it at all—and I asked, "Is that Good?" George Francis Fynn says that's not only good, it's pluperfect, for if you add them all up it totals 110. "Must be inflation," says George.

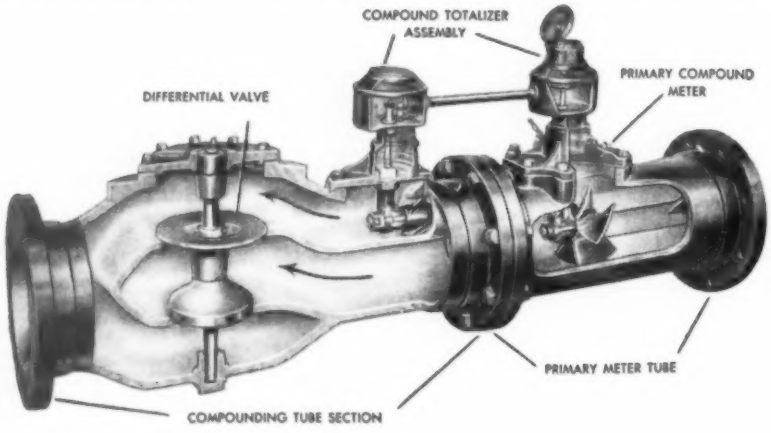
No. I didn't put in the error to catch my readers as Lloyd K. Clark (Proj. Engr. Amer. Assn. of Railroads, Baltimore, Md.), suspected, it was simply a typographical error; should have been 19 instead of 29.—But since I received only two letters on the matter, it is pretty evident that even my regular readers don't read very carefully, except two that is—Or do I only have two readers?

* * *

And speaking of letters to the Columnist, do you remember the column last July, written by the Ancient and Honorable Order of Sewer Rats of Ontario (and their wives). In that column, some mention was made of the bridge playing of one Ross C. Dobbin, Gen. Mgr. of the Peterborough (Ont.) Utilities Commission. Several members of the Pee Bees, including "Mike" Glace and "Siggie" Sigworth, wrote letters about that and even invited Ross to State College for a bridge tournament. But it was Ross's own letter which I want to give you here.

"Dear Doc: In your issue for July you were good enough to give reference to my forthcoming book on Bridge, in which I would present the 'Dobbin' system. Ever since I read Marsden Smith's book, I have been considering what I would put in mine. My system consists in depending on myself alone, and paying no attention to my partners. Of late years, these have been very mediocre, including that fashion plate, Norman Howard. —Ross C. Dobbin."

SPARLING MAIN-LINE METERS



Differential valve cracks at about one pound per square inch back pressure from the smaller meter. The smaller meter measures all flows below the minimum accurate range of the larger meter. Both meters drive through ratchet clutches to a common totalizer, which thus operates with the faster turning meter.

COMPOUNDS
for Main-Lines up to 36-inch

The standard 6-inch Sparling Meter accurately registers flows from 90 gpm to over 900 gpm. To read flows as low as 15 gpm on a 6-inch main, install the Sparling COMPOUND shown above.

Loss of head at the high flows is only 3 pounds psi. There is only one totalizer to read on the Sparling Compound, and instruments and controls can be added to suit your needs.

Sizes 6-inch to 36-inch with flanged, bell or spigot ends.

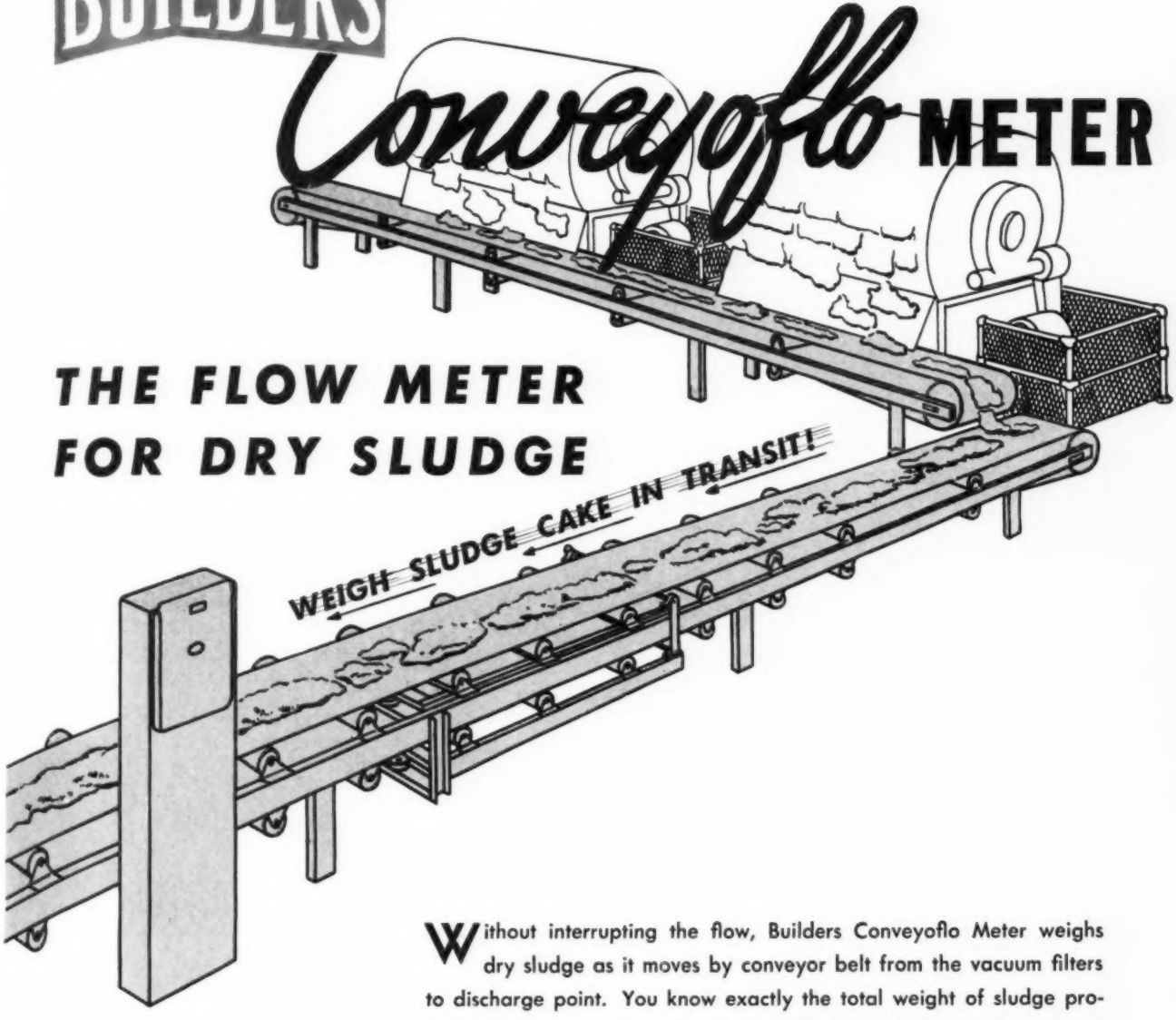
Quotations and Bulletin 310 come at your request

R. W. SPARLING
Manufacturers of WATER MEASURING EQUIPMENT

LOS ANGELES 54.....Box 3277 Terminal Annex
CHICAGO 8.....1500 South Western Ave.
BOSTON 8.....6 Beacon Street
622 Broadway.....CINCINNATI 2
101 Park Avenue.....NEW YORK 17
1932 First Avenue.....SEATTLE 1

BUILDERS Conveyoflo METER

THE FLOW METER FOR DRY SLUDGE



BUILDERS PRODUCTS

Venturi, Propelofio and Orifice Meters • Kennison Nozzles Venturi Filter Controllers and Gauges • Conveyoflo Meters Type M and Flo-Watch Instruments • Wheeler Filter Bottoms Master Controllers • Filter Operating Tables • Manometers Chronoflo Telemeters

Without interrupting the flow, Builders Conveyoflo Meter weighs dry sludge as it moves by conveyor belt from the vacuum filters to discharge point. You know exactly the total weight of sludge produced without resorting to hand-weighed samples for estimating output. The Conveyoflo Meter registers at the installation or over any distance the total weight within ± ½ of 1% of actual flow for most of its range. Rugged, air-operated weigh diaphragms are used instead of bulky overhead framework and lever system. Totalizer readings are automatically compensated for variations in belt weight which may be caused by material sticking to the return belt or the absorption of moisture. Builders Conveyoflo Meter requires minimum space and is simple to install as a complete unit or in existing conveyor systems. For complete information and Bulletin E4-550, address Builders-Providence, Inc., (Division of Builders Iron Foundry), 10 Codding Street, Providence 1, R. I.

BUILDERS PROVIDENCE

Instruments

Also following that July, 1948, column written by the Canadian boys and girls and containing the crest of the sewer rats, there came the following epistle:

"Dear Doc: For years we have been worrying about rats and the part they play in transmitting disease and in destroying our economic resources. Many of our efforts to get rid of the pests have been nullified by failure to get poison to all the rats and to locate all of the rat harborages.

"Orchids, therefore to you Doc, for revealing the harborage of one breed of rats (ratus canadensis) in the sewers of Ontario. Who would have suspected the sanitary system of Toronto of harboring such an unusual species. While we have suspected for some time that some unseen and unrecognized subversive foci of destruction was preventing the Province of Ontario from reaching a state of maturity, we never dreamed that it was this species of rats, making daytime appearances as sanitary engineers, chemical engineers, and chemists.

"We are glad to know that the gnawing at the efforts of other sanitary engineers, by representatives of the provincial government of Ontario, is in reality only the officers of the Royal Order of Sewer Rats maintaining their mammalian traits.—John M. Hepler, Dir., Div. of San. Engr., Mich. Dept. of Health."

* * *

I don't know how many of you read the "Coming Articles" on the Table of Contents page, but John E. (Indianapolis Water Co. Publicity Director) Kleinhenz does. And after one issue last fall John wrote as follows:

"Dear Doc: I just read in the announcement of the coming 'The Water Utility Manager and His Community' that 'This suggestive article comes from Robert S. Millar, Mgr., Wichita, Kas.' Now I've only met Rotarian 'Bob' Millar once but I wonder if he would do anything 'suggestive' ".

* * *

When, in November, I told the story of the "bewitching Mrs. Jacomet," the water witcher from Dayton, Leo Louis, City Engineer of Piqua, Ohio, put paper in his typewriter and wrote "I assure you I am not a member of the local Chamber of Commerce, but Piqua should get credit for having the lady water witcher."

* * *

Also in the November issue there appeared an article by one Harry A. Faber on Fluoridation. It was an excellent article, according to many readers, including Al Steffen, San. Engr., Wilson & Co., Chicago, who asked if we and Harry A. could take a small rib. On page 393, as Al pointed out, Faber said, "This defect is most pronounced in the permanent teeth as produced during the period of tooth formation, largely during the first *eighty* years."

* * *

Clinton Bogert, that New York Consulting Engr., who is a sometime lexicographer and bibliophile, wrote me one day that he had just come across a book entitled "Cleanliness and Godliness or The Further Metamorphosis" by Reginald Reynolds. Published by Doubleday and Co., the book traces the history of modern sanitary conveniences, etc. Clint said he was impressed with the paragraph which read, "Roman soldiers in the reign of Tarquin I . . . thinking themselves disgraced by being ordered to make common sewers, committed suicide in 606 B.C. Also it is notable that the sewers of the Romans were kept clean by the labor of convicts."—We still seem to be having some difficulty in selling the public on the high regard in which the sanitary engineer should be held.

THAT'S ALL THE PARTS WE STOCK--OUR BUFFALO-MADE METERS ARE SIMPLE, INTERCHANGEABLE--DON'T HAVE MANY PARTS
● Buffalo Meter *simplicity* of construction and interchangeability of parts make the stock job easier. Average maintenance requirements are readily met from a small supply of parts.
AMERICAN BRONZE CASE
NIAGARA GALV. IRON CASE
WATER METERS
BUFFALO METER COMPANY
2909 MAIN STREET, BUFFALO 14, N. Y.

Bulletin on POROUS MEDIA

by CARBORUNDUM
TRADE MARK

NO. 1 MARCH, 1949

Why Use Porous Plate Filter Underdrains?

The total elimination of graded gravel simplifies and increases the efficiency of the filtration system. Filter (or softener) media are supported directly on the porous plates of an ALOXITE aluminum oxide underdrain system. This fundamental design development offers several important advantages over conventional or special design systems that employ graded gravel to support the filter media.

Filter media is permanently protected against loss through underdrains.

Backwashing is always uniform and complete. It maintains clean filters and usually requires less water. It is accomplished in a shorter time and thus—provides longer filter runs.

Construction costs are low. Installation is simple. Vertical dimensions are reduced.

The system is versatile. It is adaptable to large or small gravity and pressure units, and can be fitted to old or new structures.

Maintenance costs are also reduced. The costly, tedious regrading of sand and gravel is eliminated. There is only one material to handle. Repairs and replacements of spray nozzles, laterals, etc., are unnecessary—metal plates and parts are largely eliminated.

These benefits have been recognized by water works technicians since the introduction of the ALOXITE system. They have measured up under years of actual operation. In the meantime, design features have been improved. As a result, present installations offer even greater practical and economical advantages.

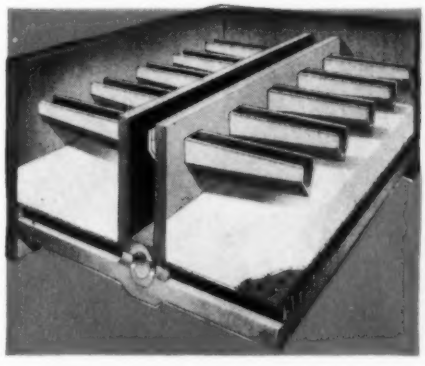
Properties of ALOXITE Porous Media

MATERIAL	Ceramically bonded crystalline aluminum oxide grain of controlled sizes.
GRADES (Pore size)	**Filter Underdrains**... coarse and very coarse. **Direct Filtration**... range from very fine to medium. **Diatomite Support**... range from fine to medium. **Air (gas) Diffusion**... range from fine to coarse (permeability from 10 to 80.)
SOLUBILITY	**In Water and Air**... permanently corrosion resistant at all normal operating temperatures. **In Acids**... generally resistant at all operating temperatures (except to hydrofluoric.) **In Alkaline Solutions**... ceramic bonds are progressively soluble with time and temperature increases.
STRENGTH	Transverse breaking strength is relatively good ranging from 1000 lbs./sq. in. (coarse grades) to 3000 lbs./sq. in. (fine grades).
REFRACTORINESS	All grades withstand up to 900° C. without softening.
THERMAL SHOCK RESISTANCE	Withstand changes up to 20° C./hr. (Where more severe heat shock exists, ceramically bonded silicon carbide porous media are available.)
POROSITY	Ratio of pore volume to total volume of all grades approximately 35%.
WEIGHT	Approximately 0.09 lbs./cu. in.

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

POROUS BOTTOM TRICKLES...

- The Carborundum Company developed the porous plate underdrain idea FIRST—in 1934.
- The first installations of ALOXITE underdrain plates at Denver, Colo. and Grand Rapids, Mich. were completed in 1936 and are still in service.
- There are now almost 200 full size installations—all over the world.
- Adaptations vary from large open gravity filters to small pressure filters or softeners.
- Rehabilitation of old filters is usually simple and inexpensive—permits them to operate at up-to-date rates of filtering and backwashing.



ALOXITE plates, of different grades, are available to support the variety of media now in use: i. e. filter sand, zeolite and ion exchange materials.

TECHNICAL DATA

on porous media and their application

is available on request. You may obtain any or all of the following engineering bulletins by writing Dept. O-39.

No. 1—Aeration of Sewage and Water.

No. 2—Underdrain Systems for Filters and Softeners.

No. 3—General Catalog information.

THE CARBORUNDUM COMPANY
Refractories Division
PERTH AMBOY, NEW JERSEY

PIPE CUTTING Made Easy!

RIGID Cutter assures clean cuts, fast, with least effort

● Slap this sturdy RIGID cutter on a pipe and roll it right through in a few easy turns, with surprisingly little effort. Efficiency-balanced, it handles easily. The tool-steel thin-blade cutter wheel sinks cleanly through pipe and conduit, leaves practically no burr—every RIGID cutter is factory-tested to make sure it tracks perfectly. Your choice of 5 sizes to 6" pipe; 4-wheel cutters to 4." Buy RIGIDS at your Supply House.

RIGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

In that connection, Clinton, W. H. (Pete to You) Wisely has come up with the suggestion that we change the name of the Federation of Sewage Works Assns. to "Federation for Water Pollution Control." Sounds Good—or do you or any of my other readers have a better idea?

* * *

Have you read enough of my mail for the nonce?

V.T.Y.—Doc.

THE SPILLWAY

[Overflow from the main section]

New Jersey S.W.A. Plans 34th Annual Meeting

Opening on Wednesday afternoon on March 23 at 2:30 P.M., the New Jersey Sewage Works Association will hold its 34th annual meeting at the Stacy-Trent Hotel in Trenton, N. J.

This meeting will feature papers on industrial waste and stream pollution control, as well as presentations on administration of sewage treatment, ground garbage, organizations of sewer authorities, etc.

Another feature of the program consists of two sessions called "The Manufacturers Speak". These are arranged by Arthur T. Clark, Secy.-Mgr. of the Water and Sewage Works Manufacturers Association.

Other papers on the program include the following in the order in which they will appear beginning Wednesday afternoon: THE WASTE DISPOSAL PROGRAM FOR A CHEMICAL MANUFACTURING PLANT, by D. J. Cestoni, Merck & Co., Inc., Rahway, N. J.; STREAM POLLUTION CONTROL IN PENNSYLVANIA, by F. B. Milligan of the Dept. of Health, Pennsylvania; CONSULTING ENGINEER'S PLACE IN THE INDUSTRIAL WASTE PROBLEM, by Peter Homack, New York City; "The Manufacturers Speak"; CONTROL OF BACTERIAL NUMBERS IN CHLORINATED SEWAGE EFFLUENT, by Rolf Eliassen and Herman L. Krieger, New York University; ADMINISTRATION OF THE PLAINFIELD SEWAGE SYSTEMS, by Joseph D'Agostino, Councilman, Plainfield, N. J.; INFLUENCE OF GARBAGE ON SEWAGE TREATMENT AT GREENWICH, CONN., by Joseph Doman, Greenwich, Conn.;

World's Biggest Sanitary Sewer Pipe built of CONCRETE

To provide for expanding sewer needs District No. 2 of the Los Angeles County Sanitation Districts has installed a new 12-ft.-diameter concrete sewer—the largest diameter concrete pipe sanitary sewer ever built in a pipe plant. Carrying effluent from a joint disposal plant in Wilmington to a special tunnel under the Palos Verdes Hills, it is 6,681 ft. long and built of precast reinforced concrete pipe.

Large or small, concrete pipe is solving today's sewer problems in dozens of cities because of its unique qualities. Its great strength resists severe impact and sustains heavy overburdens. Its smooth interior finish resists abrasion and provides maximum hydraulic capacity. Its uniformly dense structure and joints that can be made watertight assure minimum infiltration and leakage.

Individual city records covering 50 to 100 years prove that concrete pipe sewers have extra long life and cost little or nothing to maintain. Coupled with the reasonable first cost of concrete pipe, these factors mean true *low-annual-cost* service.

Photos show three views of the transport and placing of the 12-ft. reinforced concrete pipe. Upper photo taken near Lomita. Project under direction of A. M. Rawn, chief engineer and general manager, Los Angeles County Sanitation Districts.

AMERICAN CONCRETE PIPE ASSOCIATION

228 NORTH LA SALLE STREET, CHICAGO 1, ILLINOIS

BERGEN COUNTY SEWER AUTHORITY, by Donald A. Quarles, Chairman of the Sanitary Sewer District Authority, with a discussion by Ivan L. Bogert, New York City; PROPOSED RARITAN VALLEY TRUNK SEWER AND TREATMENT WORKS, by George F. Smith of the Middlesex County Planning Board, with a discussion by Dr. Willem Rudolfs of Rutgers University; another session of "The Manufacturers Speak"; TEN YEARS OF SLUDGE DIGESTION EXPERIENCE AT THE RAHWAY VALLEY SEWAGE TREATMENT PLANT, by L. J. Fontenelli, Superintendent.

The annual luncheon will be addressed by A. H. Niles, Vice Pres. of the F.S.W.A. Mr. Niles is Engineer-Supt. of the Dept. of Public Service, Toledo, O.

As usual a number of manufacturers will exhibit at this meeting.

Regular Corps Appointments for Engineer Officers in U.S.P.H.S.

Competitive examinations for appointments in the Regular Corps in the U. S. Public Health Service in grades of Junior Asst. Sanitary Engr. (2nd Lieutenant), Assistant Sanitary Engineer (1st Lieutenant), and Senior Assistant Sanitary Engineer (Captain) will be held during April 1949.

Entrance pay for the Junior Assistant Grade with dependents is $3391 a year; for the Asst. Grade, $3811 a year, and for the Senior Assistant Grade with dependents $4351 a year. Promotions are at regular intervals up to and including the grade of Senior Sanitary Engineer, which corresponds to the rank of Lieutenant Colonel, at $7019 a year. Promotion to grades above Senior Sanitary Engineer is by selection. Retirement pay after 30 years' service or at the age of 64 is $4950 a year.

Applicants must (1) be citizens of the United States at least 18 years of age; (2) have a degree in one of the several branches of engineering, from a school of recognized standing. Assistant Senior Engineer must have at least seven years educational (exclusive of high school) and professional training and experience; Senior Assistants must have eleven years training and experience.

For further information, write the Surgeon General, U.S. Public Health Service, Washington 25, D.C. Application should be submitted without delay and must be received prior to Mar. 18, 1949. The written examination is scheduled for April 11, 12, and 13, and will be held at designated service stations convenient to the candidates.

Arkansas Water and Sewage Short School

The 1949 meeting of the Arkansas Water and Sewage Conference will be devoted entirely to a Short School to be held at the lecture hall in the Municipal Auditorium in Little Rock, Ark., April 11 to 13.

This school is being held as the 18th annual conference and is in cooperation with the Departments of Civil and Chemical Engineering of the Univ. of Arkansas and the Arkansas State Board of Health.

The program will be divided into three sections: Water Purification, Meters, and Distribution. Each section will meet at three separate sessions and the last session of the distribution system will also include discussions on sewer operation in connection with water works.

The water purification sessions will deal with such topics as chlorination, corrosion, coagulation, filter operation, and chemical and bacterial analysis.

In considering replacement vs. reconditioning of a 53 year old line carrying Water to Chula Vista and National City, Calif., the California Water and Telephone Company decided to recondition the line since replacement in addition to the tremendous cost would have meant disturbing many acres of valuable citrus and vegetable fields.

Reconditioning involved a thorough cleaning by National of over 15,000 feet of 24 inch line, after which the entire line was centrilined.

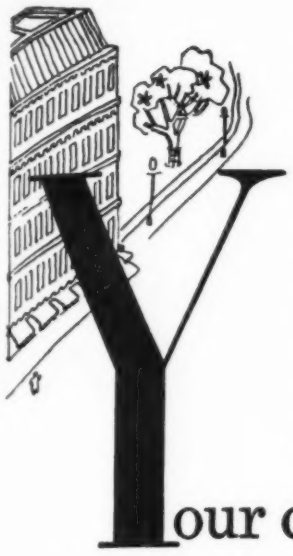
According to information received, the reconditioning has added at least 20 years more of useful life with a marked increase in the volume of water previously handled.

Our engineers will gladly submit facts and figures on how National has solved similar problems for other utilities. Why not write today?

31

NATIONAL WATER MAIN CLEANING CO., 50 Church St., N.Y. 7, N.Y.

ATLANTA, 333 Candler Building • ATLANTA, 1221 Mortgage Guarantee Building • BOSTON, 115 Peterboro Street • CHICAGO, Room 1336, 122 So. Michigan Avenue • FLANDREAU, S. D., 315 No. Crescent Street • HOUSTON, 2578 Grant Street • KANSAS CITY, 422 BMA Building • LITTLE FALLS, N. J., Box 91 • LOS ANGELES, 448 South Hill Street • OMAHA, 3812 Castellar Street • RICHMOND, 210 East Franklin Street • SALT LAKE CITY, 149-151 Second So. Street • SAN FRANCISCO, 681 Market Street • SIGNAL MOUNTAIN, TENN., 204 Slaxton Street • WACO, P. O. Box 887 • MONTREAL, 2028 Union Ave. • VANCOUVER, B. C., 505 West 1st Ave. • WINNIPEG, 576 Wall Street • HAVANA • MAYAGUEZ,, PUERTO RICO • BOGOTA • CARACAS • MEXICO CITY



Altitude Control Valves by Golden-Anderson faithfully maintain a 3" to 12" water level variation, and are designed to assure unfailing water control under all climatic conditions. A special needle valve adjustment permits proper valve speed to suit any operating requirements, while inherent water cushioning design minimizes surge and water hammer problems. These valves may be arranged with auxiliary equipment to perform a variety of water control services. Write for complete information today.

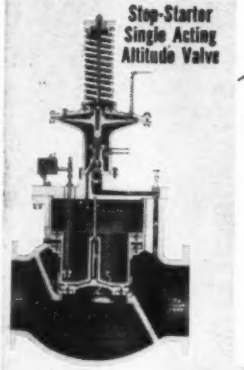
Your community...

needs the safety and lasting dependability of

GOLDEN-ANDERSON

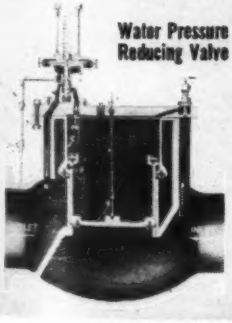
POSITIVE CONTROL

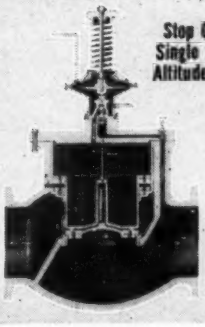
Valves

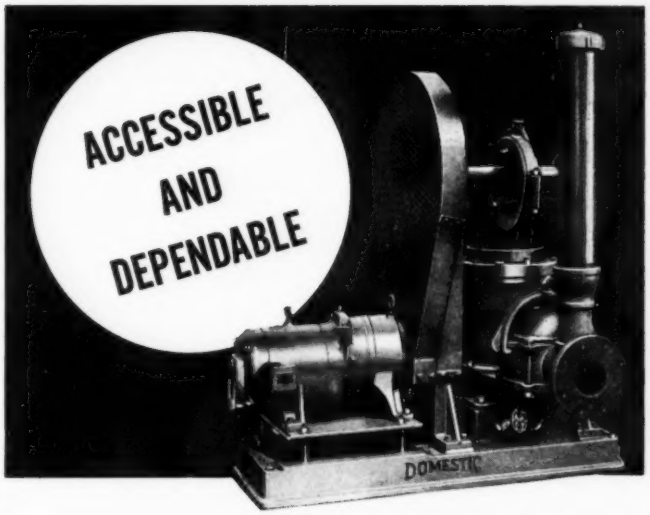


GOLDEN-ANDERSON VALVE Specialty Co.

Keenan Building • Pittsburgh 22, Pa.







"DOMESTIC"

PLUNGER SLUDGE PUMP

DESIGNED AND BUILT FOR THE EFFICIENT PUMPING OF PRIMARY SEWAGE SLUDGE

OUR 44 years of engineering and manufacturing experience assure superior construction and service.

DOMESTIC plunger sludge pumps are today performing herculean tasks in every state in the Union, many after decades of gruelling use.

Types Available: 6"—8½"—10"—and 12¾" in single, duplex and triplex types.

Capacities from 35 G. P. M. to 375 G. P. M. at heads up to 115 feet.

All sizes 5½" stroke, adjustable eccentric type.

Furnished with gear head motor and roller chain drive or constant speed motor and V belt drive.

For complete details write to Dept. W.

"If it's a job for a Pump— it's a job for Domestic"

"DOMESTIC" ENGINE & PUMP COMPANY

A DIVISION OF EMPIRE INDUSTRIES, INC.

SHIPPENSBURG, PA., U. S. A.

The meter sessions will cover such topics as shop equipment, specifications, testing, meter repair, curves, friction, capacity, and installation. Also meter cleaning, main line, and fire service metering, and master meters.

The distribution system sessions will cover such topics as practical hydraulics, main disinfection, fire flow tests, water main construction methods, and leak detection, sewer maintenance, and sewage treatment plant operation.

The conference will be followed by a licensing examination for water works operators.

The faculty will consist of various water and sewage works superintendents and manufacturers' representatives in the area, as well as members of the staff of the College of Engineering of the Univ. of Arkansas and the Arkansas State Dept. of Health.

The chairman of the Arkansas Water and Sewage Conference is Solon Sanderson of Marianna, and the secretary is Harrison Hale of Fayetteville. The program is under the chairmanship of W. A. Mayhan of Little Rock.

Prof. Barnes to Advise Argentinian Government

Prof. George E. Barnes of Case Institute of Technology, Cleveland, has been appointed consulting engineer to the engineering firm of Par-

sons, Brinckerhoff, Hall, and MacDonald of New York City, associated with Damon, Dinerman & Cia S.A. of Buenos Aires, to advise on hydroelectric projects of the Argentinian government. The specific projects are for the Salado and Juramento Rivers.

Prof. Barnes, who is head of the Dept. of Civil Engineering and Engineering Mechanics at Case, will go to Argentina during the summer months while Argentina is experiencing its rainy season with its customary flood conditions. There he will review hydrological silt measurements and make recommendations on river training and on provisions for the desilting of streams to conserve reservoir capacity for the future.

South Bend's Sewerage Project to Cost $8,000,000

$2,400,000 to Be Spent by Four Other Indiana Municipalities

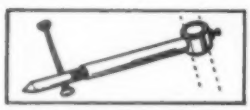
The South Bend, Ind., city council has authorized a $1,000,000 bond issue for construction of the first segments of its proposed $8,000,000 sewage and sewage treatment program designed to eliminate pollution of the St. Joseph River. Threatened court action by the State of Michigan to force the city to begin its anti-pollution program at once was a deciding factor in the city's decision to vote for the bond issue.

The Indiana Stream Pollution Control Board also has approved sewage disposal projects at Jasper, Sheridan and New Castle, involving estimated expenditure of $1,400,000, and at Rushville, where council action on awarding a bond issue for construction of sewage disposal facilities is pending.

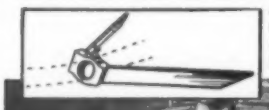
Bedford, Ind., has retained the services of engineers to explain de-

NEW—"FLEXIBLE" LOWER MANHOLE JACKS SAVE TIME AND WORK AND EQUIPMENT

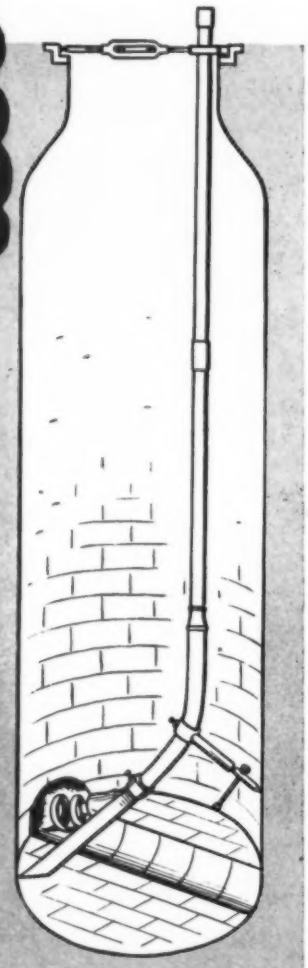
"FLEXIBLE" experience again provides new methods of simplifying tough jobs. These two new Lower Manhole Jacks brings sewer and line cleaning operations another step further into the open. They also speed tool changing. Note how the coupled rod guide is quickly, firmly, simply anchored at the bottom of the manhole. Also note that the face of the bell is held away from the lip of the sewer line itself. This enables operators to see roots before they jam tight in the rod guide.



Adjustable Back Jack (Optional use). Perfect for getting additional anchorage of rod guide. Sold separately.



Adjustable Foot Jack. Ideal for use with proven "Flexible" Steel Rod system of cleaning sewer lines. Sold separately.



Lower Manhole Jacks in position. Clear working face at sewer is provided as well as comfortably small amount of rod bend into sewer line.

ASK YOUR NEAREST "FLEXIBLE" OFFICE TODAY FOR FULL INFORMATION

FLEXIBLE SEWER-ROD EQUIPMENT CO.

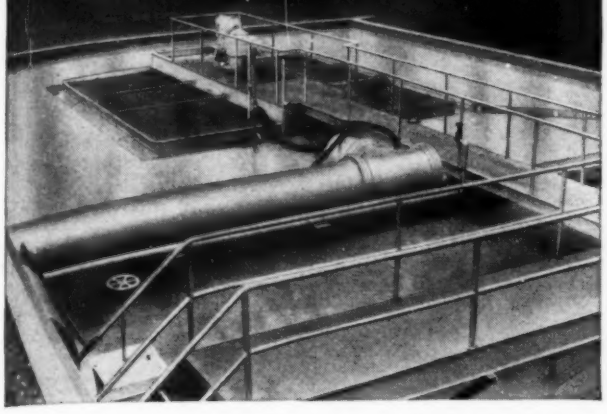
9059 Venice Blvd., Los Angeles 34, California

141 W. Jackson Blvd. Chicago, Ill. — 401 Broadway New York 13 — 147 Hillside Ter. Irvington, N. J. — P. O. Box 165 Atlanta — 2011 Central Ave. Memphis, Tenn.

801 E. Excelsoir Blvd. Hopkins, Minn. — 29 Cerdan Ave. Roslindale 31, Mass. — P. O. Box 447 Lancaster, Texas — 41 Greenway St. Hamden, Conn.

3786 Durango Ave. Los Angeles 34, Calif. — 909 N. Homewood Ave. Pittsburgh 8, Pa. — 4455 S.E. 24th Ave Portland 2, Ore.

Save UP TO 80% IN SPACE!



With The Compact ACCELATOR The Preferred Water Conditioning Plant

QUICK mixing, coagulating, settling, sludge removal . . *all* these steps are replaced IN ONE COMPACT UNIT by the ACCELATOR! Savings in space, *up to 80%*, are possible. Other superior advantages are 1. Lower construction costs, 2. Simpler operation, 3. Faster chemical reaction, 4. Higher ratings, 5. An *exclusive* slurry recirculation feature which produces better, cleaner water in less time. Over 1100 ACCELATOR installations are now softening or clarifying almost ONE BILLION gallons of water every day! Without obligation discuss your water conditioning problem with our nearest field engineer, or

SEND FOR *our water conditioning analysis sheet. Fill in and return it with a sample. You will receive our laboratory analysis and report promptly. Take advantage of this dependable free laboratory service now!*

INFILCO

• BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1894

INFILCO INC.

325 WEST 25th PLACE, CHICAGO 16, ILL.

SALES OFFICES IN TWENTY SIX PRINCIPAL CITIES

WORLD'S LEADING MANUFACTURERS OF WATER CONDITIONING AND WASTE TREATING EQUIPMENT

To Help You Use and Handle Chlorine with Safety

Like many other chemicals and drugs, chlorine properly used and handled is a boon to the health of mankind. Uncontrolled and improperly handled, however, it can be dangerous. That sanitation officials have done a good job of teaching their workers how to handle and use chlorine safely is evidenced by the tons of this chemical which are being used daily in the water works and sewage plants throughout the country.

With new workers being continually added, and with expansion in the use of chlorine, it is necessary to be ever vigilant in making sure all safety precautions are being observed. To help you maintain your impressive record of safety, Hooker has prepared a new Wall Chart on Safety in the Use and Handling of Chlorine. Printed in large readable type on linen backed paper, it is ideal for mounting wherever you use or store chlorine.

Recommendations for storage, for handling cylinders or ton containers, the proper wrenches to use, protection of equipment, and emergency measures are some of the items included. Copies of this chart, 16 x 22, are available to users of chlorine. Send for one today.

From the Salt of the Earth

HOOKER CHEMICALS

HOOKER ELECTROCHEMICAL COMPANY

Buffalo Avenue and Ward Street
NIAGARA FALLS, NEW YORK

Chlorine
Caustic Soda
Muriatic Acid

NEW YORK, N.Y. • TACOMA, WASH. • WILMINGTON, CALIF.

tails of the city's proposed $1,000,000 sewer and sewage expansion program, involving a $400,000 sewage disposal plant and more than $600,000 for laying of additional sewer lines. This project probably will be financed by revenue bonds to be paid from service charges for use of the sewers.

Nomography

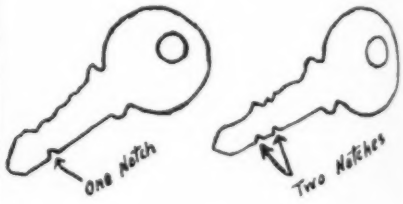
"NOMOGRAPHY" is the title of the book originally published in 1937 under the title "Alignment Charts" by Alexander S. Levens. This recent revision by Mr. Levens, Assoc. Prof. of Mechanical Engineering, University of California, is of thoroughly technical approach to the subject of the preparation and use of nomograms. Mr. Levens discusses the various types of the alignment charts which can be made from various equations and the methods for actually constructing nomograms. One chapter on practical short cuts in the design of alignment charts is of interest to persons who find nomograms so useful. The use of the nomogram (sometimes called the nomograph) has grown considerably in the past 20 years in the water and sewage works field, where there are a number of instances in which nomograms are of great value.

This book is not written for the person with limited mathematical training, but for those who desire to know how to develop and construct nomograms, the book is excellent.

"Nomography" is published by John Wiley & Sons, Inc., New York, and retails at $3.00 a copy.

Easily Identify Any Key in the Dark*

Most of us carry keys, and every once in a while we are confronted with the problem of doing an unlocking job in the dark. The question then is: Which is the right key? Here is a kink used by the writer which he has found to be unfailing:



Simply file notches in the back of the keys as shown in the accompanying sketches. The number of notches identifies the key. Thus, file one notch in the most important key, two notches in the key of second importance, three notches in the key of third importance, and so forth. It is easy to remember which key is most important, next in importance, and so on. Do that, and you will have no more identification trouble in the dark.

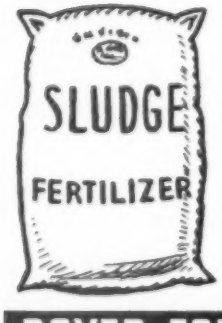
*Contributed by W. F. Schaphorst, M.E., Newark, N.J.

Jones, Henry & Schoonmaker New Firm Name for Toledo Engineers

The engineering firm of Jones and Henry of Toledo, Ohio, has announced a change in name and the admission to partnership of principal members of the firm. Effective February 1, the name of the firm is Jones, Henry and Schoonmaker. Mr. Schoonmaker, a former member of the firm, has returned to the organization after serving as City Manager of the City of Toledo for the past nine years. Mr. Schoonmaker was appointed as Chief Engineer of the Division of Water in 1937 when design and construction of Toledo's Lake Erie water supply was undertaken. He remained as Chief Engineer of the project while serving as City Manager.

ROYER SLUDGE DISINTEGRATOR

Bags an operating profit!



You can shift sludge disposal from the "loss" to the "profit" column of your department's annual statement quickly and easily—with a Royer. Undried sludge cake with as much as 56% moisture can be shovelled into a Royer along with various chemical concentrates . . . and discharged directly into bags, ready for sale as commercial fertilizer. Florists, farmers, nurserymen, golf clubs and parks are glad to get the nitrogen-rich sludge you are now burning or burying. Write for *Royer Sewage Sludge Datalog.*

ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.
170 PRINGLE ST., KINGSTON, PA.

Also admitted to partnership in the reorganization were Spencer H. Downing, Bernal H. Swab and Leon G. Williams. All three of these men have been principal members of the firm for a number of years and have had important assignments on many projects. Mr. Swab has also been associated with several other engineering firms on projects throughout this country and South America.

Mr. Downing has held posts with the Ohio State Highway Dept., the Lucas Co. San. Engr. Dept., Federal Works Administration and other consulting engineering firms. Mr. Williams was early associated with the Iowa Engr. Expt. Station, and worked on the Illinois River Investigation for the U.S. P.H.S.; he was later with the City of Long Beach, Calif., and with Greeley and Hansen Engrs. on the Buffalo, N.Y., Sewage Works, the Toledo Water Intake, and the Hampton Roads, Va., sewage works.

MANUFACTURERS' *and* EQUIPMENT NEWS

300

Oil Slick Control

Carbosand Corporation, 915 Eye St., N.W., Washington 1, D. C., has developed a new material for the removing of oil slick from water.

Known as Carbosand, the material is a finely divided sand which has been passed through a carbonation process to obtain a carbon coating. It completely removes oil from the surface of water, or from waterfront structures, by sinking it permanently. It will also remove other petroleum products lighter than water, such as paint, vehicles, thinners, etc.

Carbosand is a very finely divided product and can be distributed by compressed air much as with spray painting. When the Carbosand blankets an oil slick the resultant action can be compared to that of blotting up ink which has been spilled on a level surface. The Carbosand, having a specific gravity of 2.65, can then be sunk and carry the oil to the bottom. Sinking is accomplished by simply agitating the surface either

Alhydro FLOC PRODUCER

...REDUCES CHEMICAL STORAGE PROBLEMS IN INDUSTRIAL OR MUNICIPAL WATER TREATMENT PLANTS

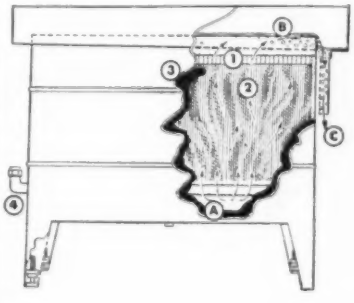
"Right!

69 lbs. of aluminum treats as much water as nearly 3/4 ton of coagulants"

By employing the principle of low voltage, DC, electrolytic dissolution of aluminum plates in water, the Alhydro Floc Producer greatly reduces the necessity for protecting and storing bulky chemicals. In addition, the Alhydro Floc Producer easily provides the simplest and most foolproof answer to the problem of removing color and suspended matter from process or drinking water. It produces a readily controllable concentration of remarkably stable floc . . . even under water conditions so adverse that floc formation would be impossible with older methods.

One Alhydro Floc Producer will treat an average of 300,000 gallons of water per day . . . but the units can be used singly or in multiples in present or proposed water treatment plants.

SKILLFUL ENGINEERING OF THE ALHYDRO FLOC PRODUCER *gives simplicity of operation . . . ease of maintenance*

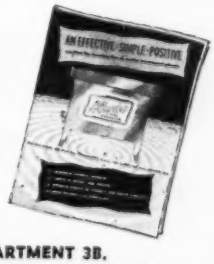


1. Connector Bar on each side of tank
2. Alternate Stainless Steel and Aluminum Plates.
3. Composition rubber lined stainless steel tank
4. Water Feed Line easily removed for inspection

A. Water enters tank through slots in feed pipe.
B. Concentrated floc is carried to the top and leaves through discharge trough.
C. Discharge pipe feeds floc to raw water.

DESCRIPTIVE FOLDER--FREE!

Read this folder which illustrates and describes the advantages of the compact Alhydro Floc Producer. See how you can simplify the treatment of drinking water or water for industrial use. Write for your free copy today.



ALHYDRO, INC. DEPARTMENT 3B. 516 N. CHARLES ST., BALTIMORE 1, MD.

by paddle or by water hose. Sinking is permanent.

This material has been suggested as usable for removing oil slick in sewers, and in sewage treatment plants where the oil may cause considerable trouble in settling tanks, etc. The settled sand can be removed and pumped as sludge with no difficulty apparently.

To obtain further information on this extremely interesting product, use a Reader Service Card on which is entered the above key number and your name and address.

301

Chlorine Safety Wall Chart

Hooker Electrochemical Co., Niagara Falls, N.Y., has issued a new chlorine safety wall chart which is intended to emphasize some of the safety precautions which should be observed in handling and using chlorine.

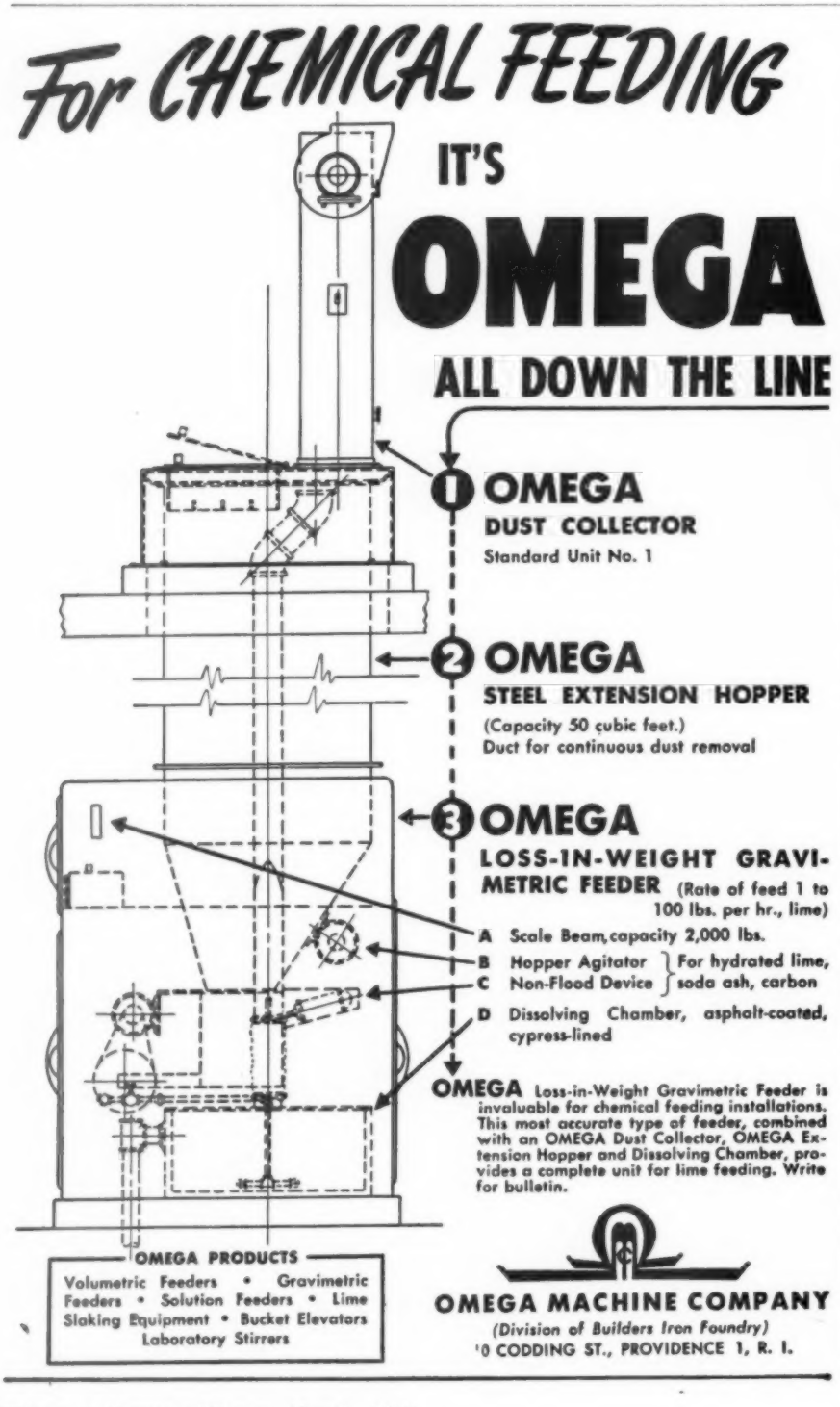
Although the chart relates particularly to cylinders and ton containers, much of the information will also be of value to tank car consumers.

This chart is intended to be prominently displayed at all points where chlorine is used. It may be obtained by entering the above key number on a Reader Service Card together with your name and address.

302

Who Wants It?

Who sent in the Reader Service Cards from Minneapolis, Minn? After the publication of our January issue, we received two Reader Service Cards requesting information on Items 1, 7, 11, 14, and 21. Both cards were marked from Minneapolis, Minn., on Jan. 12. No name appeared on either card. Who sent them?


For CHEMICAL FEEDING
IT'S
OMEGA
ALL DOWN THE LINE
1 OMEGA
DUST COLLECTOR
Standard Unit No. 1
2 OMEGA
STEEL EXTENSION HOPPER
(Capacity 50 cubic feet.)
Duct for continuous dust removal
3 OMEGA
LOSS-IN-WEIGHT GRAVIMETRIC FEEDER (Rate of feed 1 to 100 lbs. per hr., lime)
A Scale Beam, capacity 2,000 lbs.
B Hopper Agitator
C Non-Flood Device
For hydrated lime, soda ash, carbon
D Dissolving Chamber, asphalt-coated, cypress-lined
OMEGA Loss-in-Weight Gravimetric Feeder is invaluable for chemical feeding installations. This most accurate type of feeder, combined with an OMEGA Dust Collector, OMEGA Extension Hopper and Dissolving Chamber, provides a complete unit for lime feeding. Write for bulletin.
OMEGA PRODUCTS
Volumetric Feeders • Gravimetric Feeders • Solution Feeders • Lime Slaking Equipment • Bucket Elevators Laboratory Stirrers
OMEGA MACHINE COMPANY
(Division of Builders Iron Foundry)
70 CODDING ST., PROVIDENCE 1, R. I.

Changes in Calgon Kleber Succeeds Rice

John P. Kleber has been named manager of the Div. of Municipal and Process Waters of Calgon, Inc., Pittsburgh, to succeed Owen Rice, recently

J. P. Kleber

G. L. Illig, Jr.

elected vice-president in charge of industrial chemical sales.

Mr. Kleber's principal work will be the direction of technical sales and service in connection with the "threshold" treatment of municipal and industrial process water supplies with Calgon.

Named as Mr. Kleber's assistant was George L. Illig, Jr., who has previously been engaged in development and pilot plant work in this division.

303

Ferric Sulfate Available on West Coast

Stauffer Chemical Co., 636 California St., San Francisco, Calif., is now offering to western consumers a sewage treatment grade of ferric sulfate. The material is produced at the Richmond, Calif., plant of the company, and is the first to be made in the west.

For further information on this new source of ferric sulfate, use a Reader Service Card on which is entered the above key number and your name and address.

—FOR SALE—

BELL and SPIGOT CENTRIFUGALLY CAST IRON PIPE

used EXCELLENT CONDITION

(all 18 ft. lengths)

19,000 ft. of 6" diam.—Class 200
30,000 ft. of 8" diam.—Class 200
6,700 ft. of 10" diam.—Class 150
5,600 ft. of 12" diam.—Class 150
11,000 ft. of 16" diam.—Class 150
1,800 ft. of 18" diam.—Class 150
1,000 ft. of 20" diam.—Class 150
4,700 ft. of 24" diam.—Class 100

Sizes from 10" diam. and larger are cement lined with a coat of bitumastic enamel over cement.

Prompt shipment in carload quantities.

Subject to prior sale.

L. B. FOSTER CO.

(address office nearest you)

New York 7 Pittsburgh 30 Chicago 4 Houston 2 San Francisco 4

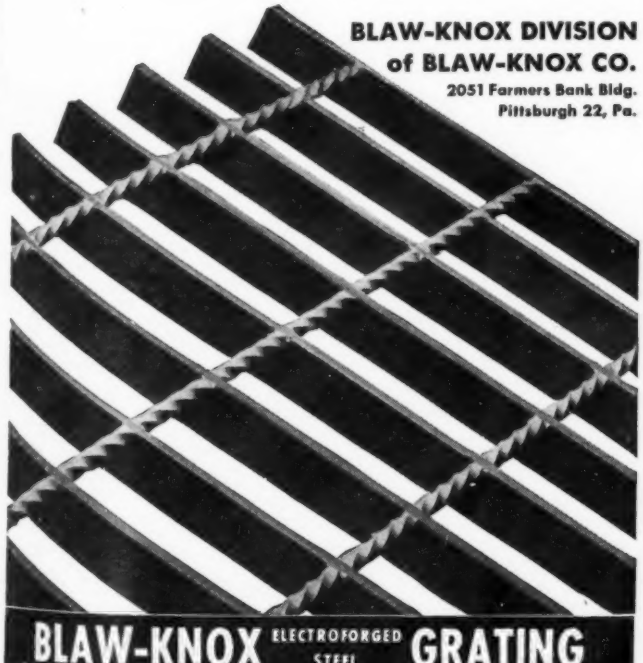
5 GOOD REASONS

for buying Blaw-Knox Grating

. . . COUNT 'EM!

1. STRONG electroforged construction for easy erection.
2. MAXIMUM OPEN AREA for light and air.
3. EASY TO MAINTAIN . . . paint reaches entire surface.
4. SELF-CLEANING, no sharp corners to clog.
5. SAFE footing at all times with twisted cross bar.

BLAW-KNOX DIVISION
of BLAW-KNOX CO.
2051 Farmers Bank Bldg.
Pittsburgh 22, Pa.



BLAW-KNOX ELECTROFORGED STEEL **GRATING**

SLASH PIPE INSTALLATION COSTS

SAVINGS UP TO 80% - 85% NOT UNCOMMON

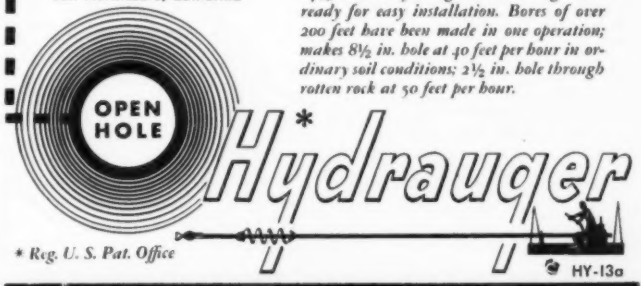
HYDRAUGER operation SAVES TIME and lots of it! With man-hour costs HIGH, it is wise ECONOMY to equip your crews with TIME SLASHING HYDRAUGERS.

The reason for HYDRAUGER ECONOMY is very simple. It bores a clean, open hole, horizontally through all formations; does it without paralyzing traffic, wrecking pavement, lawns, gardens, etc.

Write for Catalog No. 8 TODAY!

HYDRAUGER CORP., Ltd.
681 Market Street
San Francisco 5, California

The powerful air-driven HYDRAUGER machines (3.2 and 5.2 horsepower) bore and ream any size open hole from 2 in. through 14½ in. The Hydrauger bore is straight and ready for easy installation. Bores of over 200 feet have been made in one operation; makes 8½ in. hole at 40 feet per hour in ordinary soil conditions; 2½ in. hole through rotten rock at 50 feet per hour.



* Reg. U. S. Pat. Office

HY-13a

EARTH BORING TOOL

How to control and eliminate odors

This new guidebook summarizes advance knowledge of odors and offers a unique theory of odor stimulation. It provides the sewage disposal engineer with extensive information on a variety of measures for the elimination and control of odors. You're shown the methods being used to combat odors, together with many other theories and little known facts about them.

This practical guide gives you a working knowledge of olfactory physiology and control, discusses in detail the relationship between health and odors, the regulation and abatement of odor nuisances, and the legal aspects pertaining to such control.

Just Published

ODORS
PHYSIOLOGY AND CONTROL

By CAREY P. McCORD
The Industrial Health Conservancy Laboratories, Detroit

and WM. N. WITHERIDGE
Ventilation Consultant, General Motors Corporation, Detroit

Not only does this volume describe the effects of odors on health but it explains how offensive odors can cause lowered appetites for foods and waters, impair respiration, insomnia, mental perturbation, etc. Explains the forward strides medicine, chemistry, and engineering are taking towards controlling and eliminating offensive odors.

23 BIG CHAPTERS—1. The Anatomy of the Olfactory System 2. The Physiology of the Olfactory System 3. Chemical Constitutions and Odors 4. Odor Classification 5. Odor Detection and Measurement 6. The Pathology and Perversions of the Olfactory System 7. The Influence of Odors on Health and Comfort 8. Human Body Odors in Health 9. Human Body Odors in Disease 10. Odors in the Diagnosis of Disease 11. Household Odors 12. Odors of Waters and Foods 13. Industrial Odors 14. The Offensive Trades 15. Air Conditioning and Odors 16. Chemical and Physical Destruction of Odors 17. Odor Masking 18. Odor Cancellation and Counteraction 19. The Sorption of Odors 20. Odors as Warning Agents 21. Odor Repellents and Odor Attractors 22. The making of an Odor Survey 23. The Legal Aspects of Odor Nuisance.

397 pages, 6x9, illustrated, $6.50

10 DAYS' FREE EXAMINATION

McGRAW-HILL BOOK CO., Inc.,
330 W. 42d St., NYC 18

Send me McCord and Witheridge's ODORS: PHYSIOLOGY AND CONTROL for 10 days' examination on approval. In 10 days I will remit $6.50, plus a few pennies postage, or return the book postpaid.*

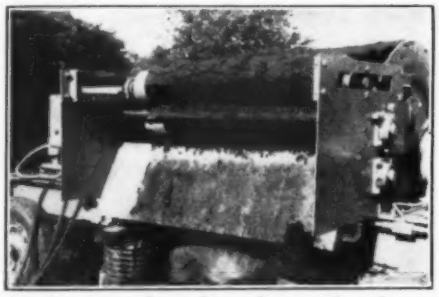
Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position WSW-2-49

*SAVE! We pay mailing costs if you send cash with this coupon. Same return privilege.

304

Coil Spring Filter

Komline-Sanderson Corp., Ridgewood, N.J., has developed and is now marketing a new idea in vacuum filtering media for the dewatering of sludge. This is the Coil Spring Filter. Described as a permanent filter media, which will give continuous operation and cannot clog, this new idea is a development from the old string or cord filters used on the rotary vacuum filters. In this case the "string" is coiled spring. Filtering takes place through the helices of two sets of coiled springs laid in corduroy fashion.



Both sets of springs leave the drum to convey the cake to the discharge roller, after which they separate to be washed before returning to the drum to furnish a new filtering surface.

Further information on this new and unique development for sludge dewatering may be obtained by using a Reader Service Card on which is entered the above key number and your name and address.

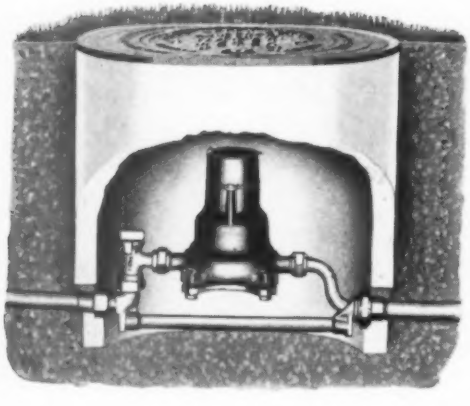
FOR HORIZONTAL METER SETTINGS

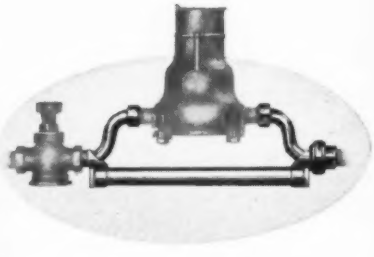
in Close Quarters

With the Ford Linesetter, meters may be set close to walls or floors, inside, outside or in meter boxes without warping or bending service pipes.

At the same time, the Linesetter provides a permanently aligned, properly spaced, electrically bonded opening for the meter.

THE FORD LINESETTER





Send for detailed information and the complete Ford catalog No. 50—FREE.

THE FORD METER BOX COMPANY, INC.

FOR BETTER WATER SERVICES

FORD

Wabash, Indiana

"Vapor Phase" Expansion

Engineering Controls, Inc., of Los Angeles and New York has reported further staff appointments and general expansion to meet the growing progress of their "Vapor Phase" Engine Cooling and Waste Heat Recovery Systems.

Charles W. Lang, formerly with Enterprise Engine & Foundry Co. and Sterling Engine Co., was appointed research and development engineer. R. A. Chamberlain has joined the staff as sales engineer, and R. E. Douglas has been promoted to assistant to the president.

Engineering Controls, Inc., headquarters are at 2835 E. 11th St., Los Angeles 23, Calif.

305

Paint Maintenance

American-Marietta Co., 43 E. Ohio St., Chicago 11, Ill., makers of Valdura paint, has issued a unique slide rule shown in the accompanying photograph.

This slide rule is operated in the usual manner to simplify the plant maintenance man's task of selecting paints for industrial uses. The new gadget is called the Valdura Painting Guide. On it one sets the surface to be painted and automatically small windows show the preparation required for the surface, the primer recommended, the correct finish coat, colors, characteristics of the finish, and the proper thinner.

To obtain one of these unique painting guides, use a Reader Service Card on which is entered the above key number and your name and address.

REA
WA

READER SERVICE CARDS for

WATER & SEWAGE WORKS

Equipment — Products
Information — Literature

JUST
CLIP
THESE
CARDS
MARK
AND
MAIL —
TO
RECEIVE
THE
LATEST
INFORMATION
OR
LITERATURE
DESCRIBED
IN
THIS
ISSUE

Place Stamp Here

WATER & SEWAGE WORKS
155 East 44th Street
New York 17, N. Y.

Place Stamp Here

WATER & SEWAGE WORKS
155 East 44th Street
New York 17, N. Y.

rite key number of
m you desire here →

our name .....

tle .....

ompany
or Dept. .....

ddress .....

.....

ATER & SEWAGE WORKS READER SERVICE

rite key number of
m you desire here →

our name .....

tle .....

ompany
or Dept. .....

ddress .....

.....

ATER & SEWAGE WORKS READER SERVICE

rite key number of
m you desire here →

our name .....

le .....

ompany
or Dept. .....

ddress .....

.....

ATER & SEWAGE WORKS READER SERVICE

rite key number of
m you desire here →

our name .....

tle .....

ompany
or Dept. .....

ddress .....

.....

ATER & SEWAGE WORKS READER SERVICE

rite key number of
m you desire here →

our name .....

tle .....

ompany
or Dept. .....

ddress .....

.....

ATER & SEWAGE WORKS READER SERVICE

rite key number of
m you desire here →

our name .....

le .....

ompany
or Dept. .....

ddress .....

.....

ATER & SEWAGE WORKS READER SERVICE

READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

Ele

Hon
Y., has
ing br
rather
unit is
the po

129 lb
driven
for op
floodli
the ge
ily be
mobile

Her
est. T
it, use
is ente
your

HE
TU

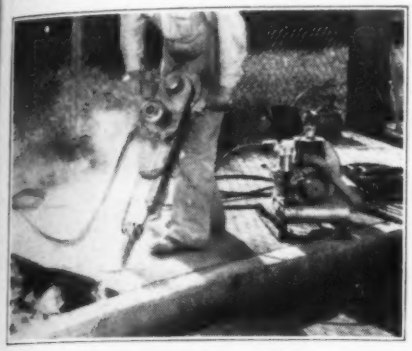
H

3708 M

306

Electric Paving Breaker

Homelite Corp., Port Chester, N. Y., has developed a new electric paving breaker. Operated by electricity rather than compressed air, this new unit is ideal for emergency work where the power is furnished by a Homelite



129 lb. dual voltage gasoline-engine-driven generator, which can be used for operating other types of tools and floodlights. The unit, together with the generator, is compact and can easily be carried in the trunk of an automobile.

Here is a new unit of unusual interest. To obtain further information on it, use a Reader Service Card on which is entered the above key number and your name and address.

HELLIGE

TURBIDIMETER

A TURBIDIMETER WITHOUT STANDARDS

Accurate • Foolproof • Universal

For MEASUREMENT OF TURBIDITY (SiO_2) DETERMINATION OF SULFATE (SO_4) AND OTHER APPLICATIONS

WRITE FOR CATALOG No. 8000

HELLIGE

INCORPORATED

3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.

REVOLUTIONARY NEW

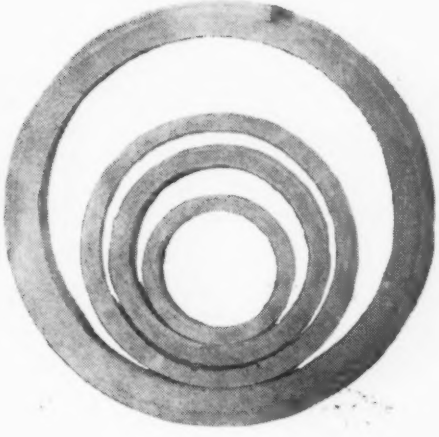
SPRING LOAD

A-C PIPE CUTTER

now available

Priced Only $59.50*

For 3" to 8" Diameter Cutter



*LARGER CAPACITIES AVAILABLE. Price does not include extra handle.

* TERRITORIES OPEN for jobbers. Write for full information.

You've never seen a cutter like this new Spring Load for fast, clean, easy cuts from Century and Transite pipe. Cutter is lightweight, simple, easy to adjust, quick operating. Saves its low cost on few small jobs. WRITE for complete details *today!*

H. D. FOWLER CO., Inc.

P.O. Box 3084 Seattle, Wash.

MAKES WATER BRIGHT

AND BETTER TASTING TOO!

STUART CORPORATION BALTIMORE

CONTRACTORS OF PUBLIC WORK SPECIALIZING IN

PALMER SURFACE WASH SYSTEMS AND KWIK-WAY FLOCCULATION SYSTEMS

ESTIMATES NO OBLIGATION

STUART CORPORATION · 516 N. CHARLES ST., · BALTIMORE 1, MD.

307

Gas Hazard Warning

Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa., has developed the M.S.A. Explosilite for warning when a dangerous concentration of combustible gas is present in the surrounding air.

The new Explosilite flashes a brilliant red signal light as a safety guard for workers in utility vaults and manholes, storage tanks, and other confined spaces. It is approved by the U. S. Bureau of Mines for use in atmospheres contaminated with methane.

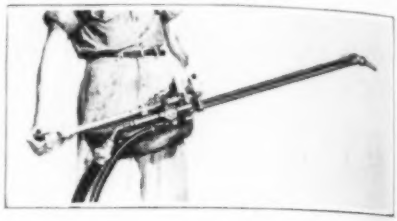
The current is supplied by a special battery which will operate from 18 to 20 hours. It operates automatically with continuous sampling of the air of a working place; in case the concentration of flammable gas reaches a dangerous point, the red light flashes.

For further information on this new safety unit, use a Reader Service Card on which is entered the above key number and your name and address.

308

Steam Gun

Oakite Products, Inc., New York, has announced the addition of a new line of steam cleaning equipment consisting of the Oakite Solution-Lifting Steam Gun, Model 481.



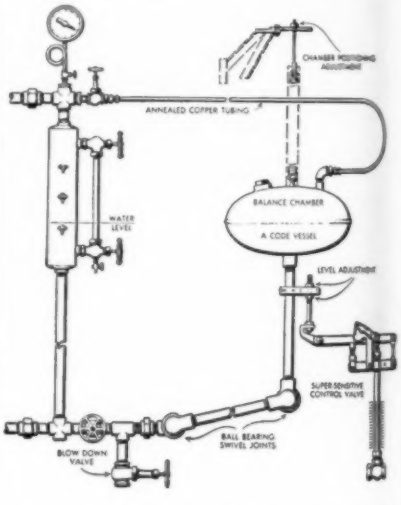
This unit is designed to facilitate volume cleaning operations in industrial plants. It has a number of features which make for ease of handling and effectiveness of operation. This type of cleaning has been used effectively in water and sewage works, particularly in the latter.

To obtain further information on this new unit, enter the above key number and your name and address on a Reader Service Card, and mail.

309

Feed Water Control

J. A. Campbell Co., 645 E. Wardlow Rd., Long Beach 7, Calif., has developed an entirely new principle of boiler feed water control which uses the weight of water as a force

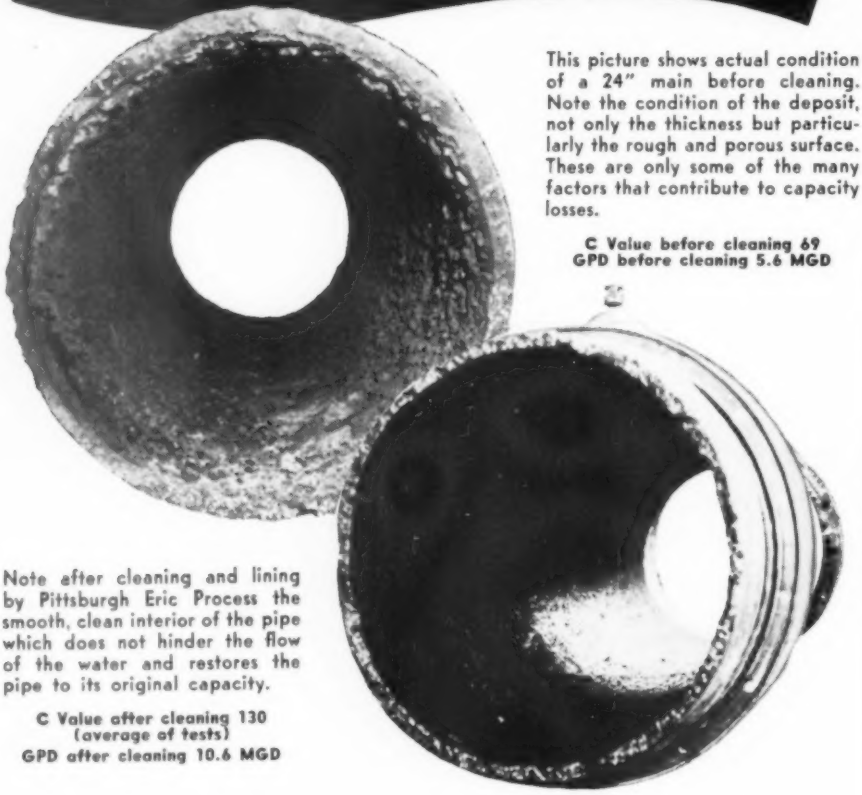


to motivate the feed water valve. No heat is required to operate the device, and heat and cold have no effect on its performance.

Known as the "Weight-O-Water", this new revolutionary controller is so sensitive that a drop of as little as 1/8 in. in the boiler will actuate the valve.

For further information on this new unit, use a Reader Service Card on which is entered the above key number and your name and address.

CAPACITY LOSSES— THEIR CAUSES AND CORRECTION---



This picture shows actual condition of a 24" main before cleaning. Note the condition of the deposit, not only the thickness but particularly the rough and porous surface. These are only some of the many factors that contribute to capacity losses.

C Value before cleaning 69
GPD before cleaning 5.6 MGD

Note after cleaning and lining by Pittsburgh Eric Process the smooth, clean interior of the pipe which does not hinder the flow of the water and restores the pipe to its original capacity.

C Value after cleaning 130
(average of tests)
GPD after cleaning 10.6 MGD

Whatever problems you have—Industrial—Municipal—Plant—Railroad—Maintenance—Supply—Engineering!!! If they pertain to water supply or sewage disposal a Pittsburgh Pipe Cleaner Company engineer can solve them. Our complete comprehensive rehabilitation program and engineering service is THE ANSWER. Write today for full details.

PITTSBURGH PIPE CLEANER CO.

133 Dahlem St., Pittsburgh 6, Pa.

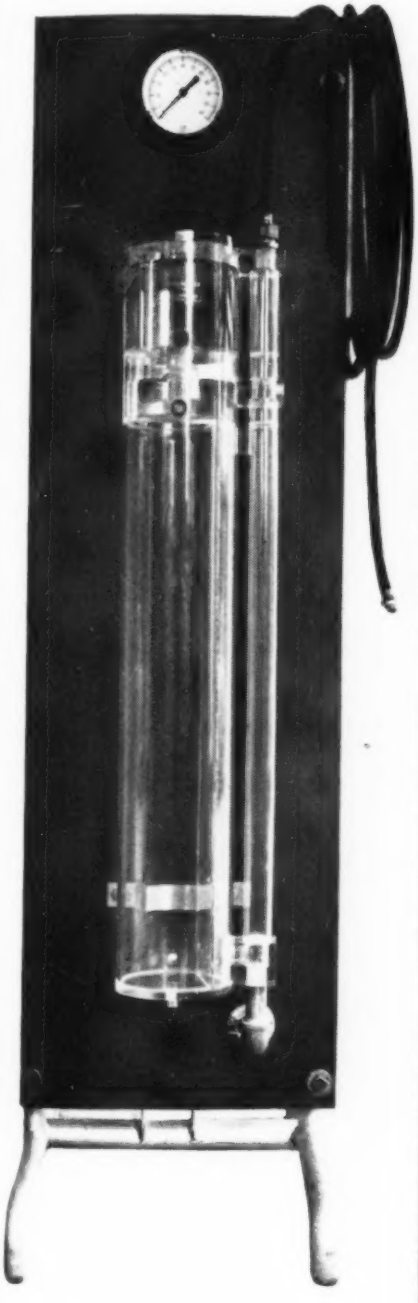
BALTIMORE • BIRMINGHAM • BOSTON • BRADENTON, FLORIDA • BUFFALO • CHARLOTTE
CHICAGO • CINCINNATI • DETROIT • HOUSTON • NEW YORK • PHILADELPHIA • ST. LOUIS

310

Chlorameter

Paulsen Development Corp., 175 Main St., White Plains, N.Y., has developed a new type of chlorine measuring apparatus for dosage of water and sewage with chlorine.

Called the Chlorameter, this item, shown in the accompanying photograph, feeds chlorine solution into



water flowing under pressure in a pipe. It is offered specifically for sterilizing dairy and ice cream equipment, sterilizing bottles, and for applications of chlorine-treated water.

To obtain further information on this new unit, enter the above key number and your name and address on a Reader Service Card, and mail.

PORTABLE WIDE-RANGE FLOW TESTING KIT

FOR LABORATORY RESEARCH AND FIELD FLOW RATE CHECKING WORK

ACCURATE
VERSATILE
INEXPENSIVE

"C-Clamp" FLOWRATOR meter kit. The meter is provided with a convenient carrying handle, base plate and hose connectors.
NET PRICE $84.50

Practically any laboratory or field problem that requires an accurate determination of the flow rates of liquids or gases is readily handled with the versatile F&P FLOWRATOR (formerly called Rotameter) flow meter kit.

The new "C-Clamp" FLOWRATOR instrument kit consists of an extremely flexible combination of one meter, four metering tubes and six readily identified floats. The selection of proper tube and float combinations is simplified. The "C-Clamp" meter construction permits easy disassembly for quick metering tube changes. Capacities from 0.065 to 2200cc/min. of water and 5.0 to 36,800 cc/min. of air are covered. Send for Catalog 30 for details.

FISCHER & PORTER CO.
DEPT. 9N-9F HATBORO, PENNA.

FLOWRATOR
TRADEMARK

Newton Replaces Lyster at Hooker Electrochemical Co.

T. L. B. Lyster, chief engineer of the Hooker Electrochemical Co., Niagara Falls, N.Y., has retired from this capacity and has been replaced by E. K. Newton, who has been with the company since 1910.

Alan A. Wood, Inc.

Announcement has been made of the formation of a new corporation, Alan A. Wood, Inc., with headquarters at 1649 N. Broad St., Philadelphia 22, Pa.

The company will specialize in steam, electrical, and chemical equipment, and offer sales and service of boiler and similar equipment in the Philadelphia area.

The company is headed by Alan A. Wood, well-known water works manufacturers' representative.

Changes in Fairbanks-Morse Sales Division

Fairbanks, Morse & Co., Chicago, has recently announced promotions and changes in the sales division of the company.

O. O. Lewis, until recently assistant sales manager, has been promoted to sales manager. Harry L. Hilleary, for the past seventeen years manager of the St. Louis branch, is transferred to Chicago as assistant sales manager. L. A. Weom, manager of the Pump Division, has become branch house manager at St. Louis succeeding Mr. Hilleary, and Donald T. Johnstone, assistant manager of the Pump Division, succeeds Mr. Weom as manager of that division.

311

Horizontal Boring Tools

Howell Utility Tool Co., 651 Bloomington Ave., Rialto, Calif., has developed a new style boring head and reamer for boring small horizontal holes to take service pipes.

Known as the DG boring tools, these units may be operated by hand or by air motor. The cutter discs can be quickly removed and replaced and will not puncture or tear hidden underground structures.

To obtain further information on this new tool, use a Reader Service Card on which is entered the above key number and your name and address.

Northrop Adds Germicide to Bond-o

Northrop & Co., Inc., Spring Valley, N.Y., has announced that since January 1 of this year the company has been adding a germicide to all BOND-O self-caulking jointing compounds which it manufactures. According to the announcement,

HOW in Jointing Bell and Spigot Main...
TO CUT MATERIAL COSTS
AS MUCH AS 89%!

IF YOU ARE NOW USING *LEAD* —

You are paying, at current prices, around 25c per lb.* On 8" pipe—joints 2" deep, each joint takes *13¾ lbs.* MATERIAL COST per joint **$3.36**

IF YOU CHANGE OVER TO *Tegul*-MINERALEAD

Your price per lb. is only.....9c*
And on that 8" pipe, each 2" joint will require only *4 lbs.* MATERIAL COST per joint .36

YOU SAVE APPROXIMATELY 89%!

AND THAT'S NOT ALL . . .

Tegul-MINERALEAD needs *no deep bell holes*, so you write off the cost of digging these . . . and *no caulking*, a still further economy to add to that 89% saving on material.

Read these figures again—then write us for full information about

Tegul-MINERALEAD The Economical—and Better Jointing Compound for Bell & Spigot Main.

*Price named for each material may vary slightly depending on amount purchased and location of job.

REMEMBER... Tegul-MINERALEAD
- Melts, pours and sets quickly in any temperature
- Maintains correct mixture
- Is proof against moisture
- Gives joints with super resistance to thermal and mechanical shock

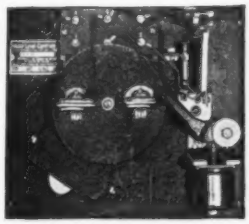
The Atlas Mineral PRODUCTS COMPANY OF PA.
MERTZTOWN • PENNSYLVANIA
15 Branch Offices. Technically qualified representatives in all states of U. S. and Hawaii.
Canada: H. L. Blachford Co., Montreal-Toronto.

"this germicide was selected as a result of considerable testing and research and is being added as a further safeguard to guarantee immunity to attack and oxidation by sulfur bacteria."

Hydro-Tite Appoints Collar Co. Rep. Kansas City

Hydraulic Development Corp., New York, has announced the appointment of the Louis H. & K. J. Collar Co., 1913 Tauromee Ave., Kansas City, Kans., as representatives for the company in Nebraska, Iowa, Kansas, and Missouri. The new representative's warehouse will stock Hydro-Tite, Fibrex and Hydro-Tite equipment.

ROTO-TROL



TYPE "A"

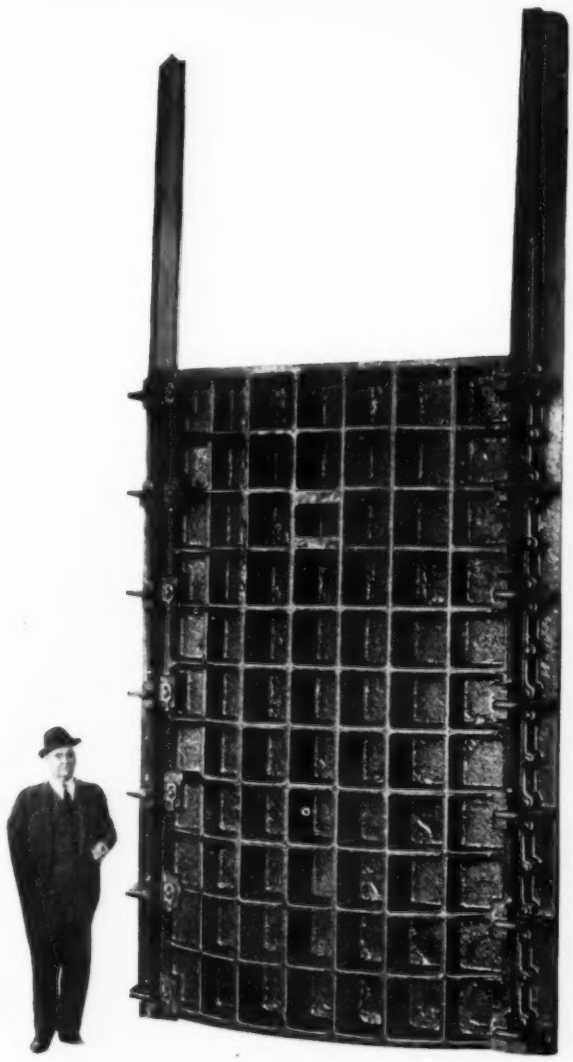
Type "A" Roto-Trol operates from the pressure in the pump discharge line, at the pump house. The electric time delay prevents starting or stopping due to surges. It also protects deep well turbines from damage due to back-spin . . . *Type "A" Multi-Pump Roto-Trol* is designed for two or more pumps discharging into the same discharge pipe. Adjusted time delays compensate for additional pumping friction and surges when second pump starts or stops.

WRITE FOR PERFORMANCE AND ENGINEERING DATA

Water Levels Control Division

HEALY-RUFF COMPANY

783 HAMPDEN AVE., ST. PAUL 4, MINN.



FILER & STOWELL SLUICE GATES

are built to stand long hard usage. Amply proportioned for all stresses of shipment, erection and operation. They may be obtained with manual, hydraulic cylinder or motor operating controls.

THE FILER & STOWELL COMPANY

MILWAUKEE 7, WISC.

ANTHRAFILT

Trade Mark Reg. U. S. Patent Office

A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.

Anthracite Institute Building
Wilkes-Barre, Pa.

All correspondence regarding sales and engineering should be addressed to:

PALMER FILTER EQUIPMENT CO.

822 E. 8th St. Erie, Pa.

Engineers and Sales Agents

BAILEY METERS AND CONTROLLERS

FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

BAILEY METERS

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

BAILEY METER COMPANY

1072 IVANHOE ROAD • CLEVELAND, O.

Bailey Meter Co. Ltd., Montreal, Canada

LITERATURE AND CATALOGS

312

MECHANICAL FLOW METERS

The Hagan Corp., Hagan Bldg., Pittsburgh 30, Pa., has published a bulletin on the **Ring Balance Mechanical Flow Meters,** Series 2200-2600. The former series is for low pressure, and the latter for high pressure flow meters. The bulletin describes and illustrates in detail with photographs, diagrams, and data the dimensions and capacities of these ring balance mechanical flow meters.

To obtain a copy of this 12-page bulletin, mail a Reader Service Card to this magazine, using the above key number.

313

FLOW TUBE

Bethlehem Foundry & Machine Co., Bethlehem, Pa., has issued a bulletin on its **Bethlehem Flow Tube** which describes its new flow measuring device.

This six-page folder combines cutaway views and engineering drawings describing in detail the principle on which the flow tubes operate.

Engineers on the look-out for means of improving the measurements or control of fluid flow through a pipe or conduit should find this folder of interest.

To obtain a copy, enter the above key number and your name and address on a Reader Service Card and mail.

314

MATERIALS HANDLING EQUIPMENT

In the No. 4 issue of **Load** published by General Electric Co., Schenectady 5, N. Y., appears an article on "Materials Handling Equipment for The Treatment of Industrial Wastes". Written by J. J. Gilbert, Engineer in Charge of Sanitary Engineering Division, Link-Belt Co., Philadelphia, this article is analysis of essential equipment which has been designed to handle and dispose of the materials particularly in industrial waste treatment.

To obtain a copy of this article enter your name and the above key number on a Reader Service Card and mail.

315

CENTRIFUGAL PUMPS

Worthington Pump & Machinery Corp., Harrison, N. J., has issued a bulletin No. W-305-B1, on **Centrifugal Pump-Types CN and CNE.**

These pumps are designed for belt, multi-v-drive, or motor drive. They are of the closed impeller type with ball bearing single-stage units. The bulletin presents diagrams and specifications with information on installation and ratings of the various pumps and different speeds. Standard pump dimensions are also given.

A copy of this bulletin on Centrifugal Pumps for pumping hot or cold water, brine, process liquors, light oils, and similar liquids may be yours if you just fill in a Reader Service Card with the above key number, your name and address, and mail.

316

CONVEYOFLO METER

Builders-Providence, Inc., Providence, R.I., has just released a new bulletin describing the new Builders Conveyoflo meter for continually weighing and totalizing the flow of dry materials.

The bulletin, titled **Builders Conveyoflo Meter,** describes the unit which may be used for automatic

Make Water Safe...

Specify Solvay Liquid Chlorine!

Here's the difference! The name Solvay is a guarantee—maintained for more than two generations—of purity and performance, uniformity and controlled quality.

—You get quick delivery, too. Solvay Liquid Chlorine is shipped in cylinders, tank cars or ton containers straight to you from three strategically-located plants.

SOLVAY SALES DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

BRANCH SALES OFFICES:
Boston • Charlotte • Chicago • Cincinnati • Cleveland
Detroit • Houston • New Orleans • New York
Philadelphia • Pittsburgh • St. Louis • Syracuse

For Water Conditioning
SOLVAY
LIQUID CHLORINE
SODA ASH
Outstanding Uniformity
Laboratory-Controlled Quality

proportioning and controlling of dry or liquid feeders for secondary ingredients. The meter operates with pneumatic diaphragm and is accurate over a wide range.

To obtain a copy of this bulletin on the Conveyoflo, use a Reader Service Card on which is entered the above key number and your name and address.

317

VERTICAL MOTOR-UNIT PUMPS

Domestic Engine & Pump Co., Shippensburg, Pa., has published bulletin 900A on **Domestic Type "LB" Vertical Motor-Unit Pump.** This four-page bulletin contains performance tables for various size pumps, and a diagram of the unit; also information on approximate dimensions for floor space, etc.

For copy of this bulletin use a Reader Service Card on which is entered the above key number and your name and address.

318

LARGE CAPACITY WATER METERS

The Pittsburgh Equitable Meter Div. of Rockwell Mfg. Co. has issued a new bulletin describing the **Pittsburgh Large Capacity Disc Type Water Meters.**

The bulletin presents the complete story of the construction of the meter which is designed for commercial and industrial services. Operating features are clearly shown by phantom view and sectional drawings. Specifications and prices for all sizes from 1½ in. to 4 in. are presented.

Also included in the bulletin is a list of repair parts for all sizes and an easy-to-follow plate of parts illustrations.

To obtain a copy of this bulletin, enter the above key number on a Reader Service Card and mail.

319

WATER DEMINERALIZERS

American Cyanamid Co., 30 Rockefeller Plaza, New York 30, N. Y., has issued a new revised 26-page booklet on **Filt-R-Stil Demineralizers.** This two-color, profusely illustrated booklet, first issued about a year ago, cites the advantages of demineralized water over distilled water, describes briefly the chemical and mechanical principles of demineralization by ion exchange, and gives data on calculating costs for demineralizing various raw waters.

To obtain a copy of this booklet, enter the above key number on a Reader Service Card and mail.

Be Sure with
BOND-O
—MACHINE BLENDED—
JOINT COMPOUND

BOND-O PACKING GASKETS
Made of bacteria-free resilient rubber. Quickest packing to install. Made in sizes 4" to 14".

8 reasons for using BOND-O

1—Self-caulking. 2—Self-sealing. 3—Homogenized by machine-blending. 4—One pound equals four pounds of lead. 5—Makes strong, tight joints. 6—Easiest to melt and pour. 7—Contains germicide to inhibit oxidation of sulphur. 8—Every Bond-o Joint is a Good Joint.

Write for literature

NORTHROP & COMPANY, INC.
SPRING VALLEY, N. Y.

Northrop

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

GRAVITY FILTERS • SOFTENING PLANTS AND EQUIPMENT • PRESSURE FILTERS ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS SPECIAL WATER TREATMENT EQUIPMENT

We invite your inquiries

ROBERTS FILTER MANUFACTURING COMPANY • *Darby, Pa.*

Dry Braided FIBREX

A SANITARY PACKING FOR WATER MAINS · SEWER MAINS

CUT YOUR COSTS IN HALF
EASIER TO USE—WILL NOT SUPPORT THE GROWTH OF BACTERIA

SEND FOR SAMPLE

HYDRAULIC DEVELOPMENT CORP.
MAIN SALES OFFICE · *General offices and works*
50 CHURCH ST. N.Y.C. · *W. Medford Sta., Boston, Mass.*

320
DEEP WELL PUMP

Peerless Pump Division of Food Machinery and Chemical Corp., Los Angeles 31, Calif., has recently issued a bulletin on its **Champion Pump.** This is a new turbine pump for small diameter deep wells and fills the gap in water production from deep wells 4 in. in diameter and larger, which is often found between domestic water systems and the larger types of deep well turbine pumps.

The bulletin shows the new pump, its construction and installation, and gives data on operation.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

321
CHLORINE FEEDERS

Everson Manufacturing Corp., 214-216 W. Huron St., Chicago 10, Ill., has available a four-page book on the **Airo-Matic,** the high capacity-automatic proportioning, progressive and retrogressive chlorine feeder for water and sewage plants. The bulletin describes the equipment, its operation, and effectiveness.

To obtain a copy of this folder, enter the above key number on a Reader Service Card and mail.

322
AUTOMATIC CONTROLS

The Mercoid Corp., 4201 Belmont Ave., Chicago, Ill., has available a catalog on the **Mercoid Automatic Control.** These controls are the mercury equipped units for heating, air conditioning, refrigeration, and various industrial applications. The catalog is complete with all types of Mercoid switches, and controls, relays, thermostats, and so forth. Among the units included are those which are used for thermostatic control and the heating of buildings, for control of the operation of unit heaters, for temperature control on boilers and so forth. These Mercoid switches have also found considerable use in connection with vacuum priming systems, temperature control of sludge digestion tanks in sewage plants, temperature and thermostatic control on water jackets for gas engine installations, etc.

To obtain a copy of this catalog on mercoid switches, enter the above key number and your name and address on a Reader Service Card and mail.

323
PLUG VALVES

H. K. Porter Co., Inc., 7001 W. 66th Place, Chicago 38, Ill., has announced the publication of the first edition of a Lubricated Plug Valve Catalog. The book contains 16 pages, fully illustrated and provided with dimensional drawings, tables and descriptive matter on the complete line of the **Porter Lubricated Plug Valves;** a full page cross-section view of the valve and an accompanying explanation is given.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

324
HIGH-CAPACITY CHLORINATOR

Paddock Engineering Co., of 900 South Ervay, Dallas 1, Tex., has a four-page bulletin on its **High Capacity Chlorinator.**

This bulletin describes the unit offered for the treatment of domestic and industrial water supplies. It contains drawings of the chlorinator, describes the operating principles, and discusses special Paddock features.

COMPARE O. S. C. SEPTIC TANK CLEANING

WITH OLD FASHIONED, UNSANITARY METHODS

When a Sanitary Service Operator puts a new Gorman-Rupp Odorless Sanitary Cleaner on the job these are the results:—

1. A disagreeable job becomes pleasant, easy work.
2. Unsanitary methods and unhealthy conditions eliminated. Septic tank cleaning with an O. S. C. unit complies with or exceeds health regulations and requirements. It banishes open tanks, diaphragm hand pumps, shovels and other makeshift equipment.
3. It does each job more thoroughly, in a fraction of the time previously required. For example, 500 gal. tanks are cleaned in 15 minutes, 1000 gal. tanks in 20 minutes.
4. It offers operators profit possibilities far in excess of income with present equipment and methods.
5. An O. S. C. unit has other profitable uses such as transporting water, emergency fire fighting, sprinkling, dewatering, etc.

Show this to Sanitary Service Operators in your community. For complete information write for Bulletin 7-ST-11.

GORMAN-RUPP'S NEW "MIDGET" 1½" PUMP

FASTEST, self-priming, most efficient pump for general use. Weighs but 62 lbs. -- pumps 5500 GPH -- self-primes up to 30 ft. -- non-clogging, sturdy. Gorman-Rupp builds a complete line of pumps from the "HANDY", delivering 8 GPM, to large capacity pumps which deliver as high as 125,000 GPH.

327 NORTH BOWMAN STREET

THE GORMAN-RUPP COMPANY

MANSFIELD, OHIO

USED CHEMICAL FEEDERS AND FLOCCULATING EQUIPMENT FOR SALE

1 — **Wallace & Tiernan Type MOH Chemical Feeder** used for hydrated lime. Capacity Min—15 lb/hr—Max 550 lb/hr. 110-volt, single phase, 60-cycle a.c. motor.

1—**Wallace & Tiernan Type MOF Chemical Feeder** used for ferric sulfate. Capacity Min 0.6 lb/hr —Max 80 lb/hr. 110 volts, single phase, 60-cycle, a.c. motor.

1 — **Wallace & Tiernan Ferric Chloride Feeder** having a range from 12½ to 200 gallons per 24 hours.

The motor in the feeder is 110 A.C.

1 — **Wallace & Tiernan Ferric Chloride Feeder** having a range from 125 to 2000 gallons per 24 hours.

The motor in the feeder is 110 A.C.

1—**Dorr Co. Flocculator**—consists of 4 horizontal shaft rotating flocculator mechanisms. The shafts are for a tank 15 feet wide. The rotating arms 6½ feet in diam. by 6 ft. long; 1HP, 220 volt 3-phase, 60 cycle, a.c. gear motor drive unit, chain drives. Paddles and shaft all metal construction. Peripheral speed of paddles adjustable from 0.9 ft/sec. min to 1.2 ft/sec. max.

1 — **Dorr Company, Inc. — 2100 G.P.M. Turbo type Flash Mixer,** with 27"-12" Sextuplex Turbo-Lifter, also 48" Diameter Steel Intake Dish with 18" Throat Opening. Also Sterling System Variable Speed-Trol Power Unit. 3HP, 220V, 60C, 3Ph.

The above equipment was installed in 1937 and has been operated in service about two weeks only. The equipment has been well maintained and is in good condition.

If you wish to make an offer or desire additional information, address correspondence to:

Mr. Robert Burrell
Superintendent
Sewage Treatment Plant
West Haven, Connecticut

To obtain a copy of this bulletin on the high-capacity chlorinator, use a Reader Service Card on which is entered the above key number and your name and address.

325
CONCRETE PIPE

The American Concrete Pipe Assn., 228 N. LaSalle St., Chicago 1, Ill., has available an attractively illustrated bulletin which presents uses of concrete pipe, "the universally accepted product".

One page discusses culverts, another concrete pipe for irrigation and drainage, and one section discusses sanitary sewers.

To obtain a copy of this interesting bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

326
pH AND CHLORINE CONTROL

W. A. Taylor & Co., 7300 York Road, Baltimore 4, Md., has issued the 8th Edition of **Modern pH and Chlorine Control.** This bulletin, which now contains prices effective as of August 1, 1948, is a 96-page book, in which is included the meaning of pH control, colorimetric methods, descriptions of color comparators and their operations, as well as the equipment for use in the determination of the pH and chlorine. Also included is the various equipment for determining phosphates, nitrates, bromides, chromates, etc. The book also includes sections devoted to the discussion of applications of this equipment to various industries, as well as the theory of ionization and its importance to pH.

To obtain a copy of this informative booklet, use a Reader Service Card on which is entered the above key number and your name and address.

327
WASTE TREATMENT

Infilco Inc., 325 W. 25th Place, Chicago 16, Ill., has issued a new bulletin on the **Cyclator.** This is another development by Infilco for effective, economical waste treatment.

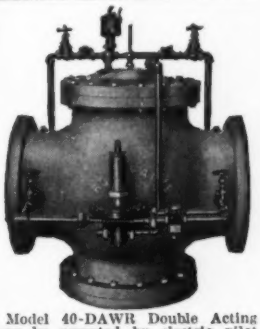
The bulletin describes the Cyclator, how it was developed, its principle of operation, and how it works on such problems as paper mill wastes and general industrial wastes.

To obtain a copy of this interesting bulletin, use a Reader Service Card on which is entered your name and address and the above key number.

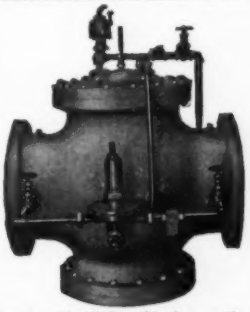
Est. 1879

ROSS AUTOMATIC VALVES

Altitude Valves for tank and reservoir, with two sets of controls—Automatic Hydraulic and Electric Remote Control. Hydraulic pilot normally operates the valve, while electric pilot is used for emergency only.



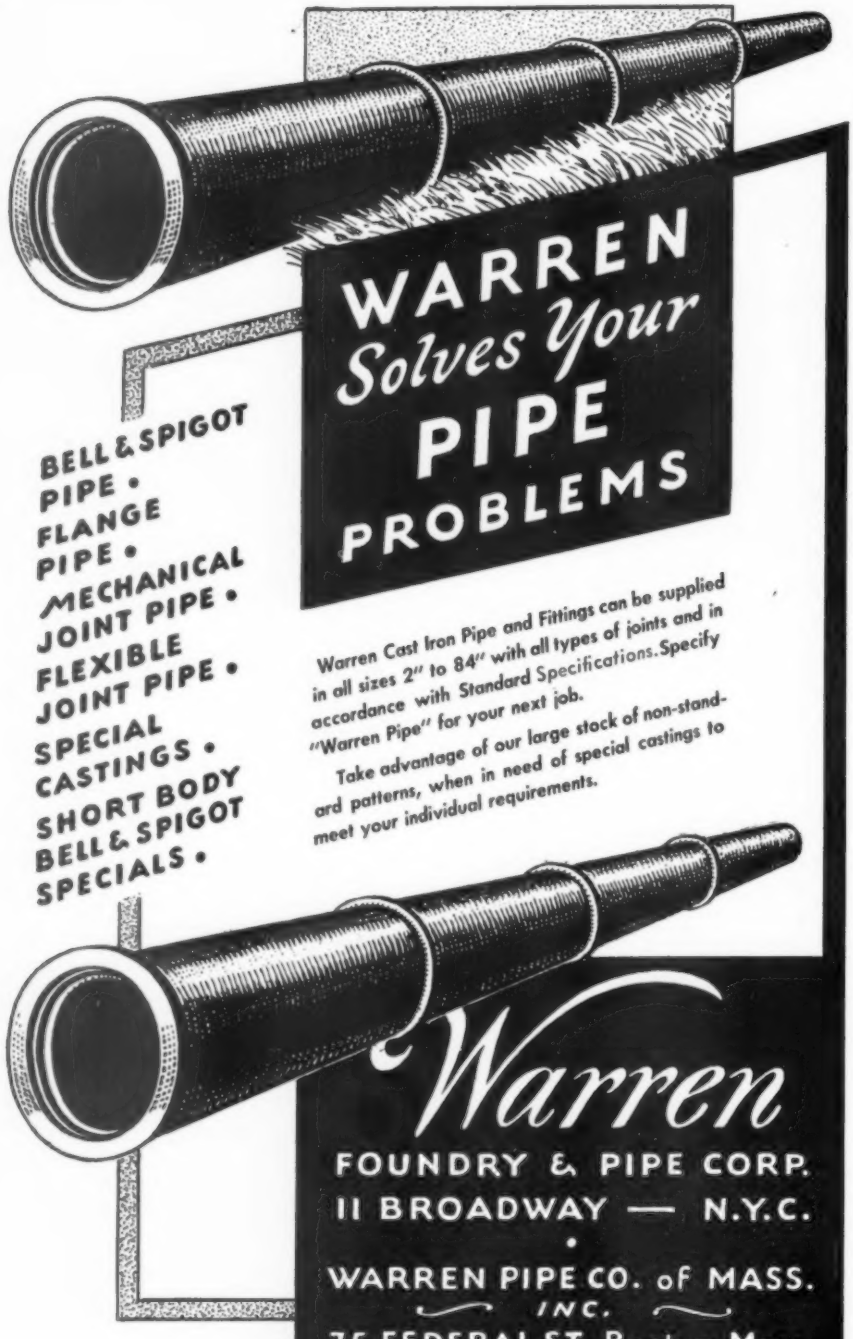
Model 40-DAWR Double Acting may be operated by electric pilot regardless of elevation of water in tank or reservoir, for a break in supply or distribution and when fire pressures require direct pumpage.



Model 30-AWR Single acting valve may be controlled in same manner as the Model 40-DAWR.

Model 40-AWR Single Acting semi-throttling valve will close on reversal of flow and the electric pilot would serve only a single purpose—either to open wide or close as emergency may require.

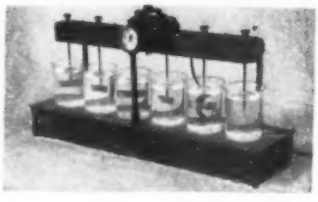
ROSS VALVE MFG. CO. Incorporated
P.O. BOX 595, TROY, N.Y.


WARREN
Solves Your
PIPE
PROBLEMS
BELL & SPIGOT PIPE •
FLANGE PIPE •
MECHANICAL JOINT PIPE •
FLEXIBLE JOINT PIPE •
SPECIAL CASTINGS •
SHORT BODY BELL & SPIGOT SPECIALS •
Warren Cast Iron Pipe and Fittings can be supplied in all sizes 2" to 84" with all types of joints and in accordance with Standard Specifications. Specify "Warren Pipe" for your next job.
Take advantage of our large stock of non-standard patterns, when in need of special castings to meet your individual requirements.
Warren
FOUNDRY & PIPE CORP.
11 BROADWAY — N.Y.C.
WARREN PIPE CO. of MASS. INC.
75 FEDERAL ST., Boston, Mass.

EDSON
DIAPHRAGM PUMPS

Hand Sizes 2", 2½", 3", 4"
Power Sizes 3" and 4"
Open Discharge or Force Pump
Edson Special Suction Hose
Red Seal Diaphragms
Strainers and Foot Valves
Hose Spanners—Adapters

THE EDSON CORPORATION
Main Office and Works: 49 D St.
South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn



Phipps & Bird
LABORATORY MIXER

IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC. Richmond, Va.

328

FLIGHT COLLECTORS

Walker Process Equipment Inc., Aurora, Ill., has published a bulletin on **Flight Collectors for Rectangular Basins.** This bulletin includes descriptive matter on suggested design and design criteria, typical layouts, collector design, and specifications.

To obtain a copy of this bulletin, enter the above key number on a Reader Service Card and your name and address and mail.

329

AIR COMPRESSOR

Ingersoll-Rand Co., 11 Broadway, New York 4, N.Y., has available a bulletin on the **Use of Air for Modern Building and Repair.**

This bulletin describes the Pac-Air compressor and I-R air tools. The Pac-Air is a portable air compressor useful in any one of a dozen ways around the water or sewage works or water distribution or sewer system.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

330

SANITATION AND PROCESS EQUIPMENT

Chain Belt Co. of Milwaukee has issued a new bulletin on **Rex Sanitation and Process Equipment** for industrial processes and liquid clarification.

Detailed information is given on Rex grit chambers, Rex grit washers, conveyor sludge collectors, Tow-Bro sludge removers, Stratified-Flo thickener, Verti-Flo thickener, skimmers, mechanically-cleaned bar screens, traveling water screens, triturators, the Rex Floctrol, flash mixers, and the A.P.I. Oil-Waste-Separators and flat spray nozzles; all equipment manufactured by the Chain Belt Co.

To obtain a copy of this complete bulletin of sanitation equipment, use a Reader Service Card on which is entered the above key number and your name and address.

331

FIRE HYDRANT

The Kennedy Valve Manufacturing Co., Elmira, New York, has a 4-page folder on the **Kennedy Safe Top Fire Hydrant.** This folder describes the Kennedy Safe Top Fire Hydrant and gives a cutaway diagram of the operating mechanism and discusses the safety breakable section.

To obtain a copy of this bulletin describing the Kennedy Safe Top

Fire Hydrant, use a Reader Service Card on which is entered the above key number and your name and address.

332

VERTICLOSED MOTORS

U. S. Electrical Motors, Inc., Milford, Conn., has issued an attractively printed bulletin on **Streamway Power for Pumps with the New Verticlosed U. S. Motors.**

Beginning with a discussion of the progress in pump motor design, the bulletin presents in several colors a cutaway drawing of the motor, shows how it operates and is manufactured, how it is lubricated, and other features of this Streamway design.

To obtain this very attractive and informative bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

333

AERO-FILTER SYSTEM

Yeomans Brothers Co., 1433 N. Dayton St., Chicago 22, Ill., has published a bulletin on **The Aero-Filter System.** This is the Halvorson-Smith process for sewage and waste treatment.

The bulletin describes the process; gives its basic advantages; presents Aero-Filter design data; discusses drainage, ventilation, filter media, tile media, distributor design, recirculation pumps, and clarifiers. Also discussed are single-stage and two-stage practice. Specifications are given in the bulletin and blueprints of the flow system are also included.

To obtain a copy of this informative bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

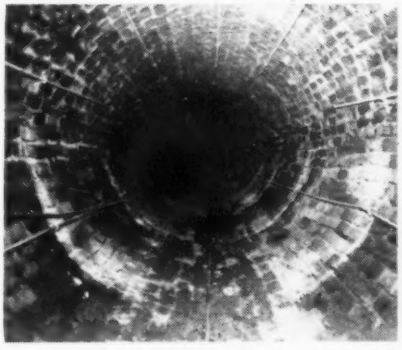
334

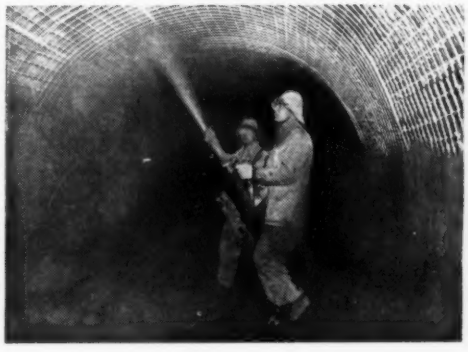
JOINT COMPOUND

Michael Hayman & Co., Inc., 856 E. Ferry Street, Buffalo 11, New York, has issued a bulletin on **Positive Pipe Joints with Haymanite.** This bulletin describes the Haymanite Jointing compounds for bell and spigot cast iron water main joints. The bulletin gives tests on the material and shows the instructions for using the Haymanite for perfect joints. Other products of the company for jointing water compounds are also included in the bulletin.

To obtain a copy of this bulletin, use a Reader Service Card on which has been entered the above key number with your name and address.

"GUNITE" RENEWS OLD BRICK SEWERS





These pictures show how we are rebuilding nearly four miles of combination sanitary and storm sewers at Bloomington, Illinois by lining them with mesh reinforced "GUNITE."

Erosion of mortar joints and dislodged bricks made many sections of these 65-year-old sewers both dangerous and inefficient. The new "GUNITE" linings will restore them to greater than original strength and result in many more decades of useful service at a fraction of the cost of new sewers.

All work is done without opening streets. Sewer service is maintained by installing temporary flumes or by-passing through relief sewers.

This job and many other profitable uses of "GUNITE" are illustrated and described in our new 64-page General Bulletin 2400. Send for your free copy today.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.
MANUFACTURERS OF THE "CEMENT GUN"

Goldak
PIPE LOCATORS

FEATHERWEIGHT
MODEL 87

Weighs only 11 pounds

- Saves TIME and MONEY by Rapidly Locating Mains, Services and Stubs
- Fast, Easy One-Man Operation
- Low Operating Cost

WRITE FOR COMPLETE DETAILS

The GOLDAK Co.
1543 W. Glenoaks Blvd.
Glendale 1, California

Leopold

GLAZED FIRE CLAY TILE FILTER

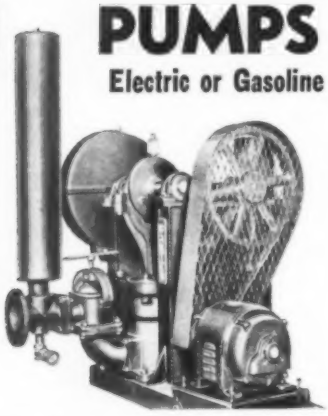
• Permanent • Non-corrosive • Economical • Impervious to acid or alkali solutions • Practically non-absorbent • Equal distribution.

Complete water purification and sewage plant equipment.

Write today for complete information

F. B. LEOPOLD CO., INC.
2413 W. CARSON ST. PITTSBURGH 4, PA.

CARTER
SLUDGE PUMPS
Electric or Gasoline

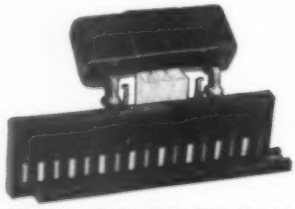


For the transfer of liquids with high solid content—in a capacity range of 100-400 gpm, specify a CARTER SLUDGE PUMP. Balto and Standard models—in single, double and triple plunger types for extra heavy duty service. Electric or gasoline powered: 1 to 25 hp.—to fit your specific job.

● **Write for our Bulletin 4502 today**

RALPH B. CARTER CO.
HACKENSACK, NEW JERSEY
186 Atlantic Street

Chlorine
DETERMINATIONS
—easy for everyone with



TAYLOR-ENSLOW
SLIDE CHLORIMETER

. . . No special training necessary. The accuracy, compactness, durability and portability of the Taylor-Enslow Slide chlorimeter makes it ideally suited to on-the-spot determinations of the free or residual chlorine content of water, sewage and industrial wastes.

Taylor-Enslow slides are molded of plastic . . . contain a complete set of 9 liquid color standards, all of which carry an unlimited guarantee against fading. Two slides are available: 0.0 to 1.0 p.p.m. and 0.0 to 3.0 p.p.m. of chlorine. Combination pH and Chlorine sets, and complete Taylor Water Analyzers are also available.

READ THIS VALUABLE BOOK—FREE

96 pages of authoritative general information for water and sewage engineers as well as describing Taylor sets. Write for your copy today—see your dealer for equipment.

W. A. TAYLOR AND CO.
7308 YORK RD. • BALTIMORE 4, MD.

335

VALVES AND HYDRANTS

M & H Valve and Fittings Co., Anniston, Ala., has a bulletin on **Valves and Hydrants.** This complete bulletin contains information on all items concerned with fire protection, indicator posts, pipe fittings, service equipment, etc., of interest to the water works engineer.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

336

HARD RUBBER MATERIALS

American Hard Rubber Co., 11 Mercer St., New York 13, N.Y., has issued a bulletin on **Hard Rubber and Plastics Handbook.** This is the first edition of the book, which describes the physical and electrical properties of hard rubber, gives tables of properties for various molded parts, shows pictures of various parts used, discusses weights, hard rubber rods and sheets, and in general gives complete information on the uses of hard rubber in all fields including the use of hard rubber pipe in water and sewage treatment.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

337

LABORATORY GLASSWARE

Corning Glass Works, Corning, N.Y., has issued two bulletins of specific interest to water and sewage works engineers, operators, and chemists. These bulletins are both devoted to **Laboratory Glassware.**

The first is a catalog and the second is a supplement with news items and price revisions. The catalog, which contains 176 pages, lists all types of laboratory glassware in Pyrex, Vycor, and Corning brands.

To obtain a copy of these bulletins, use a Reader Service Card on which is entered the above key number and your name and address.

338

INSTRUMENT SELECTION

Taylor Instrument Company, Rochester 1, N. Y., has issued a revised bulletin of the **Taylor Guide to Correct Instrument Selection.**

This bulletin gives a comprehensive view of the entire industrial instrument line, the field of application of each type of instrument, as well as its principle of operation and range limits.

No point in jointing cast iron water mains with HIGH PRICED LEAD!

Switch to
Haymanite
REG. U. S. PAT. OFF.
JOINTING COMPOUND

- **Saves 75% of costs**
- **Goes 4 times as far**
- **Eliminates caulking**
- **Needs no large bell holes**
- **Self-seals if broken**

Once Haymanite is used for a bell and spigot cast iron water main installation, you'll never want to go back to lead or any other material. Aside from its tremendous cost-saving features, Haymanite is easily applied by any workman and requires fewer tools. Immediate shipment. FREE: Illustrated catalog.

Producers also of M. H. Brand Caulking Lead.

MICHAEL HAYMAN & CO.,
INCORPORATED
ESTABLISHED 1869
870 EAST FERRY ST., BUFFALO, N. Y.

WANTED

Graduate chemist or sanitary engineer, water testing and purification plant supervision. Address replies to Shenango Valley Water Co., P.O. Box 542, Sharon, Penna.

WANTED
Supt. Water & Sewerage

Winston-Salem, N. C. (80,000) wishes to employ well-qualified man for position of Supt. of Water Works and Sewerage. Give complete information as to education, experience, references and salary desired. Applications will be kept confidential on request. Address C. E. Perkins, City Manager, Winston-Salem, N. C.

For Sale

CAST IRON PIPE
Bell and Spigot
Class 150 and 250

2,100 ft.	4 in.	14,250 ft.	10 in.
21,500 ft.	6 in.	3,000 ft.	20 in.
16,280 ft.	8 in.	11,000 ft.	24 in.
32,450 ft.	12 in.		

12 foot and 18 foot lengths

Immediate Delivery any quantity

Write — Wire — Phone

SONKEN-GALAMBA CORPORATION
2nd and Riverview (X-423)
KANSAS CITY 18, KANSAS
THatcher 9243

LEADITE

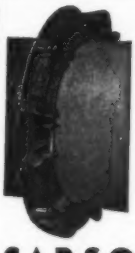
The Pioneer Self-Caulking Material for C.I. Pipe

50 YEARS PROVE IT!

• Tested and used by engineers, water works men and contractors for more than 50 years. LEADITE has proved its dependability under most every condition of water main construction . . . proved that it makes a good tight lasting joint that improves with age.

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking



STOP
JOINT
LEAKAGE
USE
CARSON CLAMPS
With Pearlitic C.I. Bolts for Cast Iron Pipe and Fittings.
Write for Prices.
Carson-Cadillac Co.
1221 PINSON ST. BIRMINGHAM, ALA.

ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

ZEOLITE CHEMICAL CO.
Sales Office 140 Cedar St., New York, N.Y.
Factory Medford, N.J.
Pioneer Producer of GREENSAND ZEOLITE MINERAL

To obtain a copy of this bulletin on instruments, use a Reader Service Card on which is entered the above key number and your name and address.

339
CURB BOXES

Opelika Foundry Co., Opelika, Ala., has a one-page release giving six reasons why water and gas engineers and superintendents specify **Opelika Curb Boxes.**

The folder shows the design of the box and gives dimensions and weights for 2½ in. cast iron service or curb boxes.

To obtain a copy of this release or further information, use a Reader Service Card on which is entered the above key number and your name and address.

340
SURGE SUPPRESSORS

The Pelton Water Wheel Co., 2929-19th St., San Francisco, has issued a bulletin on the **Pelton Surge Suppressors.** These suppressors are designed to safeguard water works flow lines against damage from sudden changes in pressure.

The bulletin describes the application and test results, and shows typical profiles of water pressure. Design, operation, and the operating cycle of the unit are described, and installations are discussed.

Also in the bulletin is a section devoted to automatic slow closing air valves.

To obtain a copy of this bulletin on surge suppressors, use a Reader Service Card on which is entered the above key number and your name and address.

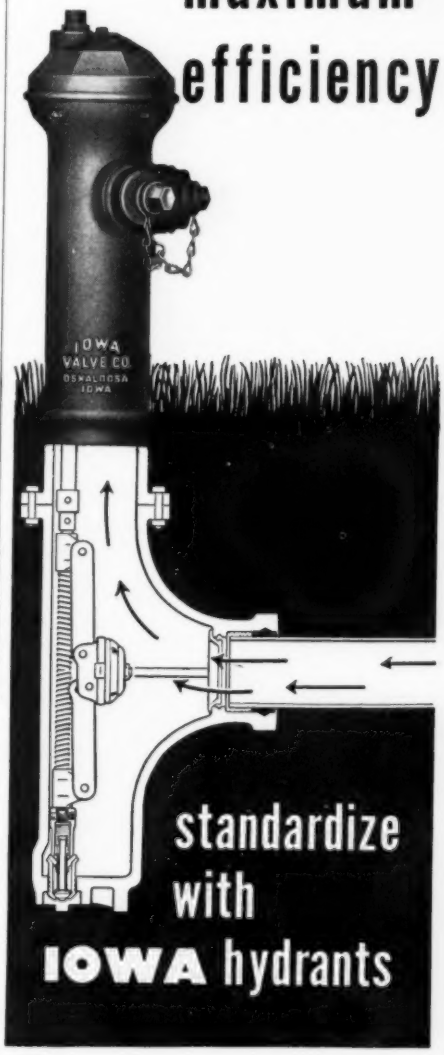
341
TRAVELING WATER SCREENS

Link-Belt Co. of Chicago, 300 W. Pershing Rd., Chicago, has available a bulletin on **Link-Belt Traveling Water Screens.** This bulletin shows cutaway drawings of the traveling screens, mechanism of the links, terminal machinery, chain and tray details, and optional features.

Also shown are a number of illustrations of installations of these screens at power and municipal water plants.

A copy of this bulletin, which is of interest to engineers concerned with the collection of raw water supply from the surface supplies, may be obtained by using a Reader Service Card on which is entered the above key number and your name and address.

for maximum efficiency



standardize with IOWA hydrants

Two piece operating nut with special adjustment screw solves the problems of expansion and contraction . . . makes Iowa hydrants easy to operate at all times.

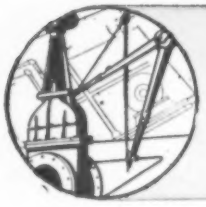
Positive operating mechanical drain valve can be removed along with all other working parts through top of hydrant without special tools.

Fixed position of valve arms makes leaking impossible should standpipe be broken.

Unrestricted water flow gives full pressure at extreme low loss of head.

Built to conform to the latest A.W.W.A. specifications.

IOWA VALVE COMPANY
201-299 N. Talman Avenue • Chicago 80, Illinois
A subsidiary of James B. Clow & Sons



Consulting Engineers

SPECIALIZING IN THE FIELD OF

WATER & SEWAGE WORKS

ALBRIGHT & FRIEL, INC.

Consulting Engineers

Water, Sewage and Industrial Waste Problems — Airfields, Refuse Incinerators, Power Plants — Industrial Buildings
City Planning - Reports - Valuations

Laboratory

1528 Walnut Street, Philadelphia 2

Alvord, Burdick & Howson

Engineers

Charles B. Burdick
Louis R. Howson
Donald H. Maxwell

Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation

Civic Opera Building — Chicago

ARGRAVES & MORT

ENGINEERS

Sewerage and Sewage Treatment
Refuse Disposal—Industrial Wastes
Water Supply and Purification—Dams

70 COLLEGE ST. — NEW HAVEN, CONN.

JOHN J. BAFFA

Consulting Engineer

Water Supply and Treatment
Sewerage and Sewage Treatment

75 West Street — New York 6, N. Y.

Michael Baker, Jr.

The Baker Engineers

CIVIL ENGINEERS AND PLANNERS
MUNICIPAL ENGINEERS

Airport Design—Sewage Disposal Systems
Water Works Design and Operation
Consulting Services — Surveys and Maps

HOME OFFICE—ROCHESTER, PA.

W. H. & L. D. BETZ

CONSULTANTS ON ALL WATER PROBLEMS

Process, Boiler and Municipal Water • Waste and Sewage Treatment • Consultation • Design • Analysis

PHILADELPHIA 24, PENNA.

BLACK & VEATCH

Consulting Engineers

4706 Broadway, Kansas City 2, Mo.

Water Supply Purification and Distribution; Electric Lighting and Power Generation,

Transmission and Distribution; Sewerage and Sewage Disposal; Valuations, Special Investigations and Reports.

Clinton L. Bogert Associates

CONSULTING ENGINEERS

Clinton L. Bogert — Ivan L. Bogert
J. M. M. Greig — Robert A. Lincoln
Donald M. Ditmars — Arthur P. Ackerman

Water & Sewage Works

Refuse Disposal — Industrial Wastes
Drainage — Flood Control

624 Madison Avenue, — New York 22, N.Y.

Bowe, Albertson & Associates

ENGINEERS

Sewerage—Sewage Treatment
Water Supply—Purification
Refuse Disposal—Analyses
Valuations—Reports—Designs

110 William St. — 2082 Kings Highway
New York 7, N. Y. — Fairfield, Conn.

Buck, Seifert and Jost

Consulting Engineers

(Formerly Nicholas S. Hill Associates)
Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction Operation Management, Chemical and Biological Laboratories

112 East 19th St. — New York

BURNS & McDONNELL ENGINEERING COMPANY

Consulting Engineers 50th Year

Water Works, Light and Power, Sewerage, Rate Investigations, Reports, Designs, Appraisals

P.O. Box 7088, Country Club Sta.; Office, 95th and Troost Avenue, Kansas City 2, Missouri

Camp, Dresser & McKee

Consulting Engineers

6 Beacon Street, Boston 8, Mass.

Water Works and Water Treatment; Sewerage and Sewage Treatment; Municipal and Industrial Wastes; Investigations and Reports; Design and Supervision; Research and Development; Flood Control.

CAPITOL ENGINEERING CORPORATION

Engineers—Constructors—Management

SEWAGE SYSTEMS — WATER WORKS
Designs and Surveys — Roads and Streets
Planning — Airports
Bridges — Dams

Executive Offices
DILLSBURG, PENNSYLVANIA

The Chester Engineers

Water Supply and Purification, Sewerage and Sewage Treatment, Power Development and Applications, Investigations and Reports, Valuations and Rates.

210 E. Park Way at Sandusky, Pittsburgh 12, Pa.

DE LEUW, CATHER & COMPANY

Water Supply — Sewerage
Railroads — Highways
Grade Separations—Bridges—Subways
Local Transportation

Investigations — Reports — Appraisals
Plans and Supervision of Construction

150 North Wacker Drive — Chicago
79 McAllister Street — San Francisco 2, Calif.

Fay, Spofford & Thorndike

Engineers

Charles M. Spofford — Ralph W. Horne
John Ayer — William L. Hyland
Bion A. Bowman — Frank L. Lincoln
Carroll A. Farwell — Howard J. Williams

Water Supply and Distribution — Drainage
Sewerage and Sewage Treatment — Airports
Investigations and Reports
Designs — Valuations
Supervision of Construction

Boston — New York

GANNETT FLEMING CORDDRY AND CARPENTER, INC.

ENGINEERS

Pittsburgh, Pa. — Scranton, Pa.
HARRISBURG, PA.

Water Works, Sewage, Industrial Wastes & Garbage Disposal—Roads, Airports, Bridges & Flood Control. Town Planning, Appraisals, Investigations & Reports.

GILBERT ASSOCIATES, INC.

Engineers and Consultants

Power Plant Engineering
Water Supply and Purification
Sewage and Industrial Waste Treatment
Chemical Laboratory Service

New York — Reading, Pa. — Washington
Houston — Philadelphia

Ivan M. Glace

Consulting Sanitary Engineer

WATER SUPPLY AND PURIFICATION
SEWERAGE AND SEWAGE TREATMENT

Design, Construction and Supervision of Operation

Telephone 6-0407 — 1001 North Front St. Harrisburg, Pa.

WILLIAM A. GOFF, INC.

General Engineering and Consulting Services—Water, Sewerage, Refuse Incineration, Industrial Buildings, Power Plants, Airport, Town Planning Plans, Supervision, Valuations, Reports

Broad St. Station Bldg., Philadelphia 3, Pa.

GREELEY AND HANSEN

Engineers

Samuel A. Greeley — Paul Hansen (1920-1944)
Paul E. Langdon — Kenneth V. Hill
Thomas M. Niles — Samuel M. Clarke

Water Supply, Water Purification
Sewerage, Sewage Treatment
Flood Control, Drainage, Refuse Disposal

220 S. State Street, Chicago 4

Havens & Emerson

W. L. Havens C. A. Emerson
A. A. Burger F. C. Tolles F. W. Jones

Consulting Engineers

Water, Sewage, Garbage, Industrial Wastes, Valuations—Laboratories

Leader Building, Cleveland 14 — Woolworth Bldg., New York 7

MOORE & OWEN

Engineers

WATER, SEWAGE, INCINERATION
REFUSE DISPOSAL, AIRFIELDS
COMPLETE WATER & SEWAGE
LABORATORIES, INDUSTRIAL WASTES

1456 N. DELAWARE ST.
INDIANAPOLIS 2, IND.

Russell & Axon

Consulting Engineers

Geo. S. Russell F. E. Wenger
Joe Williamson, Jr.

Water Works, Sewerage, Sewage Disposal Power Plants, Appraisals

408 Olive Street, St. Louis 2, Mo. — Municipal Airport, Daytona Beach, Fla.

Hayden, Harding & Buchanan

Consulting Engineers

John L. Hayden
John H. Harding Oscar J. Campia

Waterworks, Sewerage, Civil, Mechanical, Electrical, Structural

826 Park Square Building, Boston, Mass

Nussbaumer, Clarke & Velzy, Inc.

Newell L. Nussbaumer Irving Clarke

Water Supply and Treatment
Sewerage & Sewage Disposal
Garbage Incineration
Town Planning

52 Vanderbilt Ave., N. Y. City

327 Franklin St., Buffalo, N. Y.

J. E. SIRRINE Company

Engineers

Water Supply & Purification
Sewage & Industrial Waste Disposal
Stream Pollution Reports
Utilities, Analyses

Greenville, South Carolina

Charles Haydock

Consulting Engineer

Water Works and Sanitation, Industrial Wastes, Design, Construction, Operation and Management. Reports and Valuations.

COMMERCIAL TRUST BUILDING
PHILADELPHIA 2

PARSONS, BRINCKERHOFF, HALL & MACDONALD

G. Gale Dixon, Associate

ENGINEERS

Dams, Water Works, Sewerage, Airports, Bridges, Tunnels, Traffic & Transportation Reports, Highways, Subways, Foundations, Harbor Works, Valuations, Power Developments, Industrial Buildings

51 Broadway, New York 6, N. Y.

Benjamin L. Smith & Associates

Engineers

Investigations — Reports
Designs — Supervision — Valuations
Municipal Engineering and Public Utilities

11 North Pearl Street
Albany 7, New York

Jones, Henry & Schoonmaker

(Formerly Jones & Henry)

Consulting Sanitary Engineers

Water Works
Sewerage & Treatment
Waste Disposal

Security Bldg., Toledo 4, Ohio

Malcolm Pirnie Engineers

Civil & Sanitary Engineers

Malcolm Pirnie Ernest W. Whitlock
Richard Hazen G. G. Werner, Jr.

Investigations, Reports, Plans
Supervision of Construction and Operations
Appraisals and Rates

25 West 43rd St., New York 18, N. Y.

STANLEY ENGINEERING COMPANY

Consulting Engineers

Water Works—Sewerage
Electric Power—Flood Control
Rate Studies—Valuations—Industrial
Airports . . . . . Municipal Buildings

Hershey Bldg., Muscatine, Ia.

ENGINEERING OFFICE OF CLYDE C. KENNEDY

COMPLETE ENGINEERING SERVICE
For More Than a Quarter Century

Investigations, Reports, Design, Supervision of Construction and Operation
Water Supply, Water Conditioning, Sewerage, Sewage and Industrial Waste Treatment

CHEMICAL and BIOLOGICAL LABORATORY
604 Mission Street, San Francisco, 5

The Pitometer Company

Engineers

Water Waste Surveys, Trunk Main Surveys, Water Distribution Studies
Penstock Gaugings

New York, 40 Church St.

Philip B. Streander & Affiliates

Consulting Engineers

120 Tremont St., Boston 8, Mass.

Water Supply, Treatment, Distribution
Trade Wastes, Refuse Disposal
Sewerage, Sewage Treatment
Plans, Supervision, Reports

Morris Knowles, Inc.

Engineers

Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning

1312 Park Building, Pittsburgh, Pa.

LEE T. PURCELL

Consulting Engineer

Water Supply and Purification
Sewerage and Sewage Disposal
Industrial Wastes
Design, Supervision of Construction and Operation
Complete Laboratory Services

1 LEE PLACE
PATERSON 1, NEW JERSEY

Weston & Sampson

Water Supply, Water Purification, Sewerage Sewage and Industrial Waste Treatment. Corrosion Control, Laboratory Service
Supervision, Valuations

14 Beacon St., Boston, Mass.

WM. S. LOZIER CO.

Sewerage, Sewage Disposal, Water Supply, Water Purification
Refuse Disposal

Consulting Engineers

10 Gibbs Street, Rochester 4, N. Y.

Thomas M. Riddick

Consulting Engineer and Chemist

Municipal and Industrial Water Purification, Sewage Treatment, Plant Supervision, Stream Pollution Investigations, Chemical and Bacteriological Analyses.

369 East 149th Street
New York 55, N. Y.

Whitman & Howard

Engineers (Est. 1869)

Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.

89 Broad St., Boston, Mass.

Metcalf & Eddy

Engineers

Water, Sewage, Drainage, Refuse and Industrial Waste Problems
Airfields Valuations
Laboratory

Statler Building, Boston

ROBERT AND COMPANY ASSOCIATES

INCORPORATED

Architects & Engineers

• ATLANTA •

WATER SUPPLY • INCINERATORS
SEWAGE DISPOSAL • POWER PLANTS

WHITMAN, REQUARDT AND ASSOCIATES

Engineers — Consultants

Civil—Sanitary—Structural—Mechanical—Electrical. Reports, Plans, Supervision
Appraisals

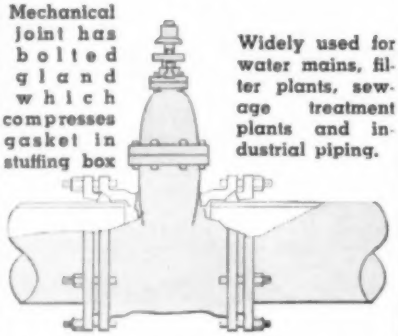
1304 St. Paul Street
Baltimore 2, Maryland

Mechanical-Joint

HYDRANTS & VALVES

In addition to bell-and-spigot and flanged, we now offer M & H Valves and Hydrants with mechanical-joints for use with standardized mechanical-joint Cast Iron Pipe.

Mechanical joint has bolted gland which compresses gasket in stuffing box



Widely used for water mains, filter plants, sewage treatment plants and industrial piping.

VALVES: A.W.W.A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals.

M & H PRODUCTS INCLUDE

FIRE HYDRANTS
GATE VALVES
TAPPING VALVES
WALL CASTINGS
SPECIAL CASTINGS
TAPPING SLEEVES
CHECK VALVES
FLOOR STANDS
EXTENSION STEMS
SHEAR GATES
MUD VALVES
VALVE BOXES
FLAP VALVES
SLUDGE SHOES
FLANGE AND FLARE FITTINGS
FLANGED FITTINGS
B & S FITTINGS
CUTTING-IN TEES

M & H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

INDEX TO ADVERTISERS

A

Alhydro, Inc. 87A
Allied Chemical & Dye Corp. 96A
American Concrete Pipe Ass'n. 81A
*Anthracite Equipment Co. 95A
*Atlas Mineral Products Co. 94A

B

*Bailey Meter Co. 95A
Bethlehem Fdry. & Mach. Co. 15A
Blaw-Knox Co. 89A
Buffalo Meter Co. 78A
*Builders Iron Foundry 77A
*Builders-Providence, Inc. 77A
Byers Co., A. M. 23A

C

Carborundum Co. 79A
Carson-Cadillac Co. 103A
Carter Co., Ralph 102A
Cast Iron Pipe Research Ass'n. 24A-25A
Cement Gun Co. 101A
Chain Belt Co. 21A
Chicago Bridge & Iron Co. 7A
*Chicago Pump Company 71A
Clow & Sons, Jas. B. 20A
Crane Co. 26A

D

Darling Valve & Mfg. Co. 19A
Diamond Alkali Co. 17A
Directory of Engineers 104A-105A
Dixie Tank & Bridge Co. 18A
Domestic Engine & Pump Co. 83A
Dorr Co. ..... Third Cover
Dresser Mfg. Div. 12A

E

Eddy Valve Co. 22A
Edson Corporation, The 100A

F

Fairbanks-Morse 10A
Fischer & Porter 93A
Filer & Stowell Co. 95A
*Flexible Sewer Rod Equipment Co. 84A
*Flexible Underground Pipe-Cleaning Co. 84A
Ford Meter Box Co. 90A
Foster Co., L. B. 89A
Fowler Co., H. D. 91A

G

Goldak Co. 101A
*Golden-Anderson Valve Specialty Co. 83A
Gorman-Rupp 98A

H

Haymen & Co., Michael 102A
Healy-Ruff 95A
*Hellige, Inc. 91A
*Hooker Electrochemical Co. 85A
Hough Co., Frank G. 27A
Hydrauger Corp. 89A
Hydraulic Development Corp. 97A

I

Industrial Chemical Sales 9A
*Infilco, Incorporated 85A
Iowa Valve Co. 103A

J

*Jeffrey Mfg. Co., The 11A
*Johns-Manville 16A-73A

L

Layne and Bowler, Inc. 72A
Leadite Company 103A
Leopold Co., Inc., F. B. 101A
Lock Joint Pipe Co. ..... Second Cover

M

McGraw-Hill Book Co. 89A
*M. & H. Valve & Fitting Co. 106A
Mathieson Chemical Corp. 4A
Mathews Hydrants 14A

N

National Water Main Clean. Co. 82A
Neptune Meter Company 30A
Northrop & Co., Inc. 97A

O

*Omega Machine Co. 88A

P

Pacific Flush-Tank Company 8A
Phipps & Bird, Inc. 100A
*Pittsburgh-Des Moines Steel Co. 75A
Pittsburgh Equitable Meter Co. 3A
Pittsburgh Pipe Cleaner Co. 92A
Posey Iron Works, Inc. 6A
*Proportioners, Inc. 28A

R

Ridge Tool Co. 80A
Roberts Filter Mfg. Co. 97A
Roots-Connersville Blower Corp. 74A
*Ross Valve Mfg. Company 99A
Royer Fdry. & Mach. Co. 86A

S

Solvay Sales Division 96A
Sonken-Galamba Corp. 102A
*Sparling, R. W. 76A
*Stuart Corp. 91A

T

Taylor & Co., W. A. 102A
Thomson Meter Co. 30A

U

*U. S. Pipe & Fdry. Co. 29A

W

*Wallace & Tiernan Co., Inc. ..... Back Cover
Warren Foundry & Pipe Corp. 100A
Welsbach Corp. 13A
Wood Company, R. D. 14A

Z

Zeolite Chemical Co. 103A

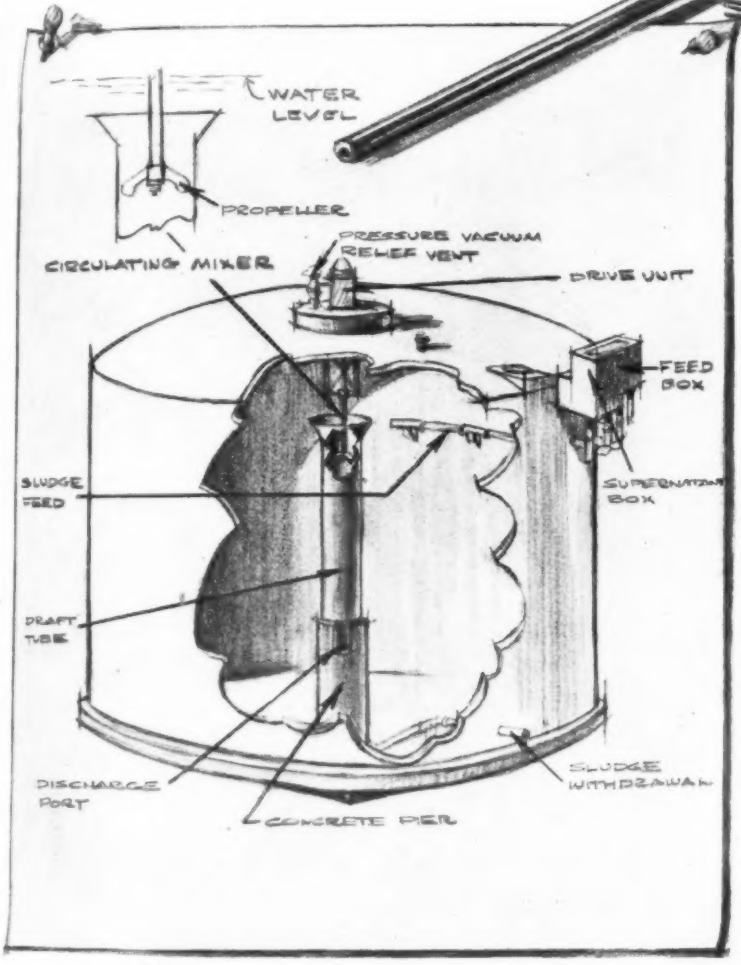
*Advertisers with * were represented in the April, 1948, Convention and Data Edition with catalog specification copy. Please refer to that issue for additional information on behalf of their products.

What does intensive mixing mean in Digester operation?

Here's what Mr. Norman Wagner, Superintendent of the Stamford, Conn. Sewage Treatment Plant reports . . .

TESTS WERE RECENTLY CONDUCTED at the Stamford, Conn., Sewage Treatment Plant to measure the effect of intensive mixing on scum formation in Dorr Digesters. A 50′ dia. Primary Dorr Digester with a fixed steel dome was equipped with a draft tube and high-capacity circulating mixer arranged so that conditions within the tank could be observed. As typified by Mr. Wagner's comment, results were definite and conclusive:

"During testing of Dorr Digester equipped with a high-capacity circulating mixer, we allowed scum to build up for a period of one week. The result was a scum layer a foot thick ...which disappeared after only 60 minutes of mixing."



✓ *Scum formation was positively eliminated. All scum was submerged by mixing action.*

✓ *Action was* rapid . . . *60 minutes to eliminate 1 foot scum layer . . . an hour and a half to turn over entire tank contents.*

✓ *Continuous operation of the mixer was not required.*

✓ *Intermittent operation of the mixer maintained a homogenous sludge mixture.*

The draft tube and circulating mixer demonstrated at Stamford are now standard on Dorr Type M and MA Digesters. Several installations featuring this new development are now being made . . . one of which comprises 18 110′ dia. units, each equipped with 3 mixers. A Dorr engineer will gladly furnish more detailed information on this new and proven development.

DORRCO

THE DORR COMPANY, ENGINEERS
570 LEXINGTON AVE., NEW YORK 22, N. Y.
ATLANTA • TORONTO • CHICAGO
DENVER • LOS ANGELES
RESEARCH AND TESTING LABORATORIES
WESTPORT, CONN.
SUGAR PROCESSING
PETREE & DORR DIVISION, NEW YORK 22, N. Y.
ASSOCIATES AND REPRESENTATIVES
Dorr Technical Services and Equipment Are Also Available Through Associated Companies and Representatives in the Principal Cities of the World. Names and Addresses on Request.

DORR

RESEARCH [illegible] EQUIPMENT

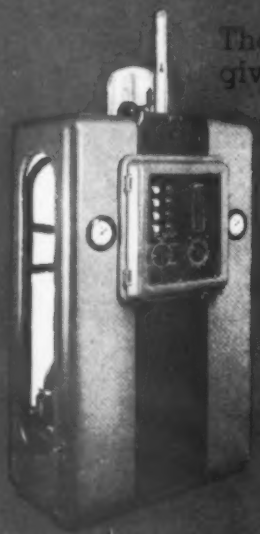
tomorrow's newspaper today

Evidence today points to more stringent stream pollution laws tomorrow—so why not prepare *now* to meet what will surely be a future necessity and in the meantime take advantage of *all* the benefits of chlorination?

In addition to effluent sterilization, a modern W&T Chlorinator can assist you in preventing septicity, reducing hydrogen sulfide corrosion, preventing filter ponding and sludge bulking, controlling odors, reducing B.O.D. and in many other work-saving ways—all at a cost of only about 1% of total plant investment. Pretty cheap insurance, isn't it?

Get in touch with your nearest W&T Representative today. There's no obligation and you'll find that he can give you the benefits of—

- W&T's 35 years' experience in chlorination
- Extensive research and development facilities
- A full line of quality equipment built to meet every chlorination problem
- The experience gained through making thousands of installations all over the world.



The Program Controlled Chlorinator

WALLACE & TIERNAN
COMPANY, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES